The Welding Engineer

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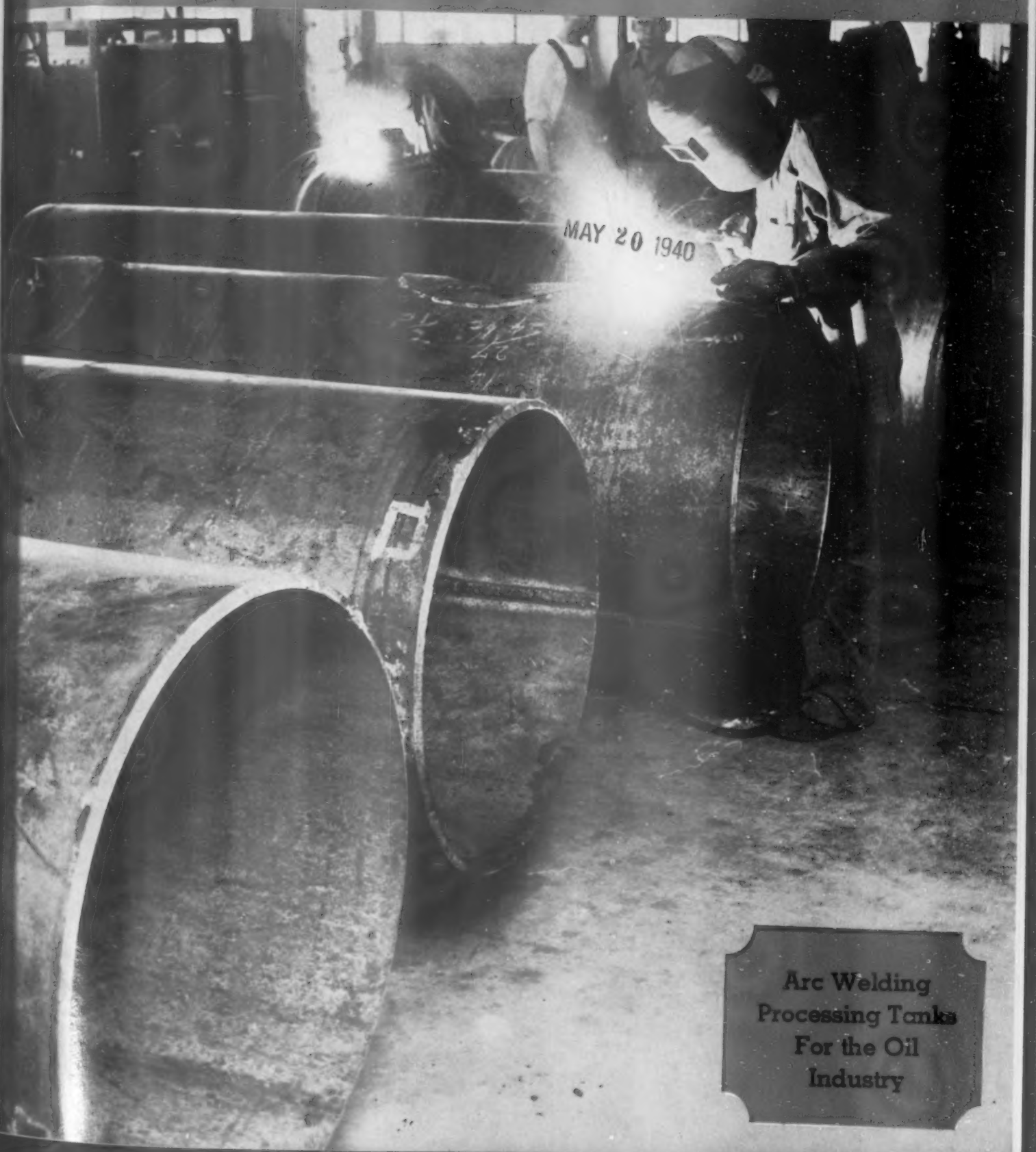

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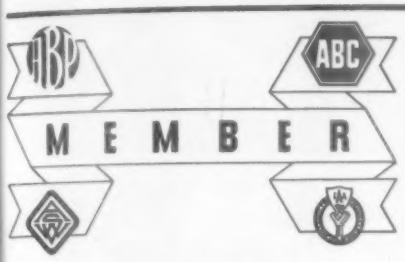
The Welding Engineer



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"Arc Welding Processing Tanks For the Oil Industry." Photo through courtesy of Black, Sivalls and Bryson, Inc., Oklahoma City, Okla.

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Too Many Doctors?

WELDING has come of age. Industry has become seriously interested in this robust youngster. Yet it has not been easy by any means to win the engineering acceptance which welding now enjoys. This seems only natural with any radically new technical development. Engineers are traditionally conservative and new ideas have to acquire enough momentum to overcome the innate skepticism so characteristic of all individuals who wish to proceed cautiously. Thus it seems only natural that we have had two schools of thought regarding proper development of welding. There seems to be an unavoidable and continuing conflict between the aggressive spirit of technical pioneers and the ultra-conservatism of another group of engineers, whose chief responsibilities have to do with conserving enormous capital assets and assuring proper service performance of fabricated equipment.

To our way of thinking, this conflict of opinion is a mighty good thing. As a result of it, a comparatively new development like welding is forced to develop along a middle-of-the-road course. If technical development steers too far to the "left," welding might very easily get a bad name and its advancement might be seriously jeopardized. On the other hand, if technical development goes too far to the "right," industry might be deprived of numerous economic benefits, because of the unjustified conservatism of those engineers who hesitate to consider a new process.

An outstanding exponent of welding, J. F. Lincoln, has made his point of view very clear through numerous public utterances. It is quite generally known that Mr. Lincoln believes that welding development suffers from "too many doctors." Here, for example, is a recent sample of his line of reasoning: "The public is beginning to think that the welding operator is a cross between a miracle man and a professional musician. This opinion is groundless. The only thing that a welding operator can do is to hold the end of an electrode at a certain distance above the deposited metal and advance it along the seam to be welded at a certain speed. There is nothing more than that involved in this operation. It is neither complicated nor difficult. As a matter of fact, with proper electrode, proper setting of the welding machine and proper preparation of the work, it is practically impossible to make a weld which will not stand up in service, without having it so evident to the inspector that he would immediately reject it."

Now, we know a good many people who will not subscribe to Mr. Lincoln's thesis. They are daily encountering experiences in the shop and in the field which apparently convince them that this job of welding is not as simple as falling off a log. There are plenty of headaches, even in the best equipped and most competently supervised fabricating shops. From among this group, we should be hearing more than we do. Those who differ with Mr. Lincoln, seem to shy away from publicity. This is to be regretted because for an orderly balanced development of welding, we should be guided by opinions from both the aggressive and the conservative camps.

In concluding his side of this perpetual debate, Mr. Lincoln reminds us: "It is time that we recognize the fact that the metal deposited by the shielded arc electrode is definitely better than the parent metal it is joining. It is time we recognize that there has never been a failure on an insured pressure vessel made by the shielded arc process. It is time we recognize that in the usual design, if only half a weld is made it will withstand all of the normal requirements of the structure. It is time we recognize that failures in welds which are made by the methods recommended by any reliable manufacturer never occur. It is time we recognize that there is no mystery in welding and that making a welded joint is far more simple than making a riveted joint and more simple than making the steel which is joined together by this process."

Will the opposition become more articulate? Let's keep our eyes and ears open and wait patiently.

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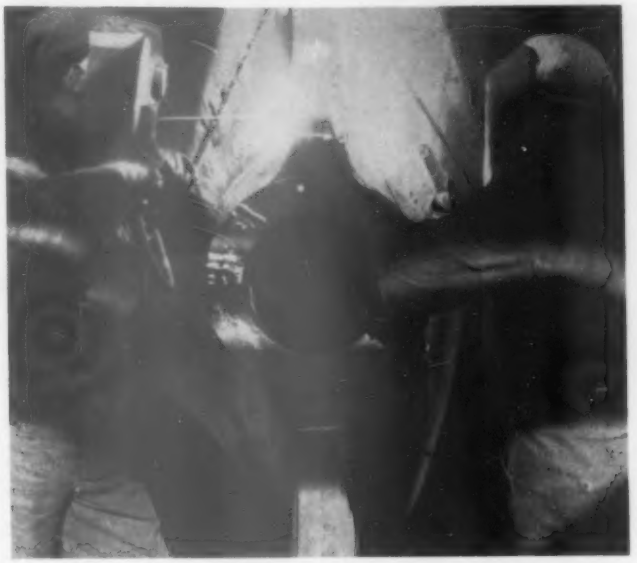


Welding propellor shaft housing on all-welded tug. Photo (Metal & Thermit Corp.)

Some of the practical difficulties encountered in

Welded Ship Construction

★ Too much emphasis cannot be placed on properly prepared joints—Deposition of root beads is most difficult part of shipyard welding.

By FLOYD R. GORMAN

RESEARCH LABORATORIES are continually employed in studies leading to a more exact determination of the value of welding and of the extent to which it may be used in ship construction, and while probable behavior in service can, in most cases, be predicted from laboratory tests, structures which have failed in service present excellent opportunities to discover the weak links, be it design, material, methods of manufacture or welding techniques.

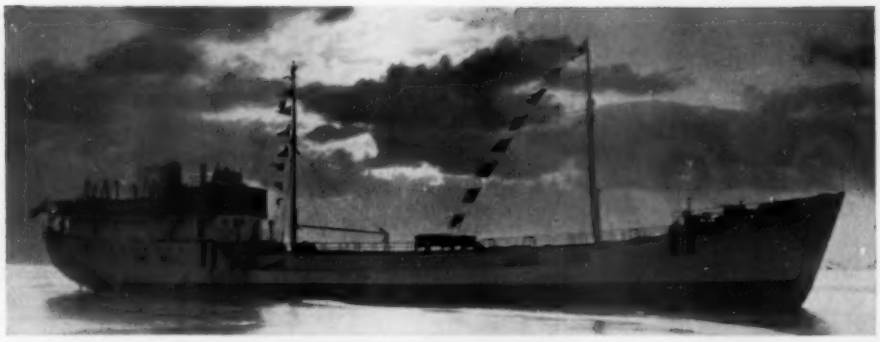
Such results as have been reported in the technical literature indicate that all weld metal deposited in the field will have a certain amount of minute porosity and contain some slag inclusions, which can act as stress raisers providing a source for the start of fatigue cracks. The most frequent defects in butt welds are lack of penetration at the root and along the vee of the weld.

Evidence obtained as a result of witnessing the welding of numerous welders' qualification tests, and investigating the probable cause of failures occurring both in the test plates and finished structures, appears to substantiate the above claims, because in almost every case of failure the weld contained evidence of slag pockets, lack of penetration in spots or some other of the many faults of technique.

This appears to place the blame directly upon the welder who to a large extent has been left to his own resources to overcome the various handicaps and difficulties of making a sound dependable weld. It might be said that the major cause of carelessness on the part of the welder is his lack of sufficient technical training to understand the effects of small but frequent defects. This knowledge, it is believed, would promote greater efforts to avoid trapping slag or the covering up of other obvious defects which are directly due to carelessness, or lack of supervision.

Heretofore, little has been heard from the welder himself, and the author, having had practical experience as a welder, has endeavored to piece together a few of the conditions which make it difficult for the average welder to turn out a sound and dependable weld, even though he is fully qualified and careful.

A great deal of emphasis can be placed upon properly prepared joints,



An all-welded diesel-driven tanker "B1WI" built according to the Kjekstad "open-framing" system in a Norwegian shipyard. Dead weight is 1100 tons. Size: 200 ft. x 31 ft. x 12ft. 6 in. Photo (J. Kjekstad).

their location for accessibility and freedom from obstructions. If satisfactory joint preparation is obtained, the actual welding operation is simplified, but if the joint preparation is such as to require skillful manipulation of the electrode, the chances are that a defective weld will result.

Structural mechanics as a rule are not readily available to correct ill-fitting joints once they have been prepared. When a structure pulls out of alignment ahead of finish welding, or the amount of root opening changes due to shrinkage, the welder not realizing the consequences and fearful of censure for causing delays soon learns to do the best he can with it. This fear of censure is also present among the welding supervisors, who, not having a voice in regard to preparation, fail to request corrections unless they are of major proportions.

Depositing First Bead

Assuming that the welder and equipment is qualified, it is the small but frequent ill-fitting, or poorly prepared areas, which cause large numbers of defects in welds.

Practically speaking the deposition of the first or root bead is the most difficult part of the welding operation. In the case of wide root openings without backing structure, a careful selection of welding current is necessary to enable the welder to control the deposit. In practice the amount of opening varies, and it not being practicable to adjust the welding machine in proportion to the variation, the welder draws upon his dexterity, in manipulating the electrode.

In some cases he resorts to breaking the arc momentarily, or to wide movement of the electrode to waste the heat to prevent burning through too deeply. This practice results in a series of irregular deposits and the severe burning of the metal. The quality of a weld deposited in this manner is very doubtful, because the greater the number of stops and starts, the greater are the chances of porosity and slag entrapment. Wide openings also influence the severity of "magnetic blow" which affects the stability of the arc and causes a series of erratic deposits which lack fusion. Thus it may be seen that this type of joint requires exceptional skill on the part of the welder if a satisfactory weld is to be obtained.

Chipping Reverse Side

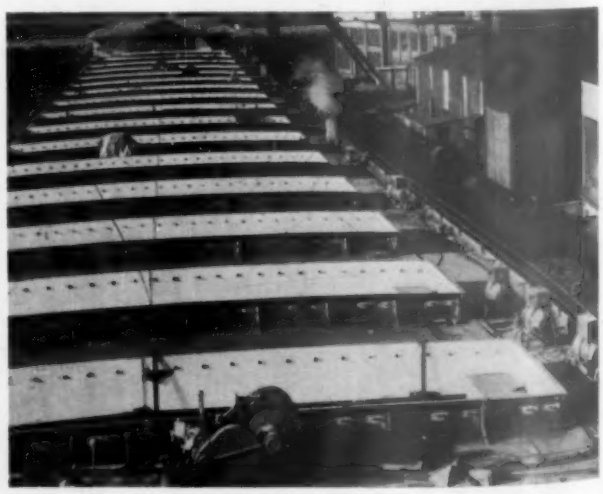
It has become standard practice to chip the reverse side of unstrapped butts and beveled tee joints to sound continuous weld metal after one side has been welded and before any welding is done on the opposite side. This practice, while practicable and effective if properly carried out, has gradually weakened efforts to provide uniform root openings because it is felt that if the weld does not penetrate to the opposite side of the joint, the chipping will expose such areas to the back up weld, and thus penetration will be complete.

However, the chipping is usually entrusted to chippers with no welding knowledge and being encouraged by inexperienced and careless welders he endeavors to cut a groove of uniform depth to accommodate a single bead of weld metal. The small but frequent areas lacking complete penetration and which the chipper failed to gouge out are believed to be corrected by penetration of the back up weld.

Weld Penetration

This, however, cannot be relied upon, because in ordinary manually welded structures, weld penetration rarely exceeds 1/16 in. and in most cases is even less than this. The volume of weld metal applied with present practice of welding, with a series of small parallel beads, speed of travel and plastic state of deposit, is such that the time element is too short to bring the base metal up to sufficient fluidity to flow freely or to remain fluid long enough for deep penetration and floating out of impurities. Consequently the small hair line cracks and occasional slag pockets remain as stress raisers which seriously affect the fatigue strength at that point.

Another consequence of close-fitting roots in deck butts, beveled stiffener face plates to decks, etc., with the idea of chipping the reverse side for complete penetration, is that the areas of butts, where they are crossed by the webs of stiffeners or deck beams, cannot be effectively chipped in way of the faying surface of the crossing member. This area must be sufficiently wide to insure full penetration from the welded side, or there may be a slight gap in the welding at the root which cannot be effectively chipped from the opposite side, without cutting through the web of the stiffener or deck beam.



Construction view of deck of motorship "William A. Irvin". A total of 15 single-operator d-c. arc welding machines was used in fabricating this bulk cargo ship. Size: 611 ft. x 60 ft. beam x 33 ft. depth, weight 5600 tons. Photo (General Electric Co.).

Arc welding the deckhouse on motorship "William A. Irvin", built by American Ship Building Co. for the Pittsburgh Steamship Co. Photo (General Electric Co.).

The difficulties of welding single-vee butts with wide root openings are greatly reduced, if a temporary butt strap of light-weight material is fitted to the back side, which may be chipped off after the welding is completed. It serves as an excellent aid to the welder in overcoming the tendency to burn through too deeply. It reduces welding time since a normal current may be used.

Backing Strip

In the case of double-beveled butts in heavier plate, a wide root opening may be overcome by inserting a strip of flat bar or sheared plate edge edgewise in the groove just far enough to close the opening but not to protrude beyond the apex. Weld the side opposite the flat bar and chip the flat bar out to sound weld metal. The chipping is easily accomplished by the use of the tool commonly known as an "oyster knife" to rip the inserted piece near the weld. Later remove the remaining particles with a round nose.

The above methods may appear too costly for general practice, but after witnessing the struggle of welding such an opening together with the large amount of difficult chipping of the reverse side to remove slag pockets and irregular weld metal, it is actually less costly. Without some backing structure, the welding time is long and welding is difficult. Chipping time is longer because the protruded weld metal is hard and brittle and does considerable damage to cutting tools. The weld also contains many slag pockets and irregularities which if properly chipped out require complete sacrifice of the root bead, before the joint is in condition to receive the back-up weld.

Many welders, due to peak load conditions and shortage of qualified welders, have been rushed through a short preliminary training in the manipulation of the electrode and have not acquired sufficient knowledge and dexterity to be trusted with the welding of different positions in important connections, especially highly stressed ones. And since it is not alway expedient to reserve certain classes of work for less experienced welders, we frequently find them assignd to positions for which their experience and adaptability are wholly inadequate.

Competent Instructors

The author recommends a follow-up system of instruction aboard the ship, particularly for newly-graduated students and welders. The instructor should be qualified to demonstrate suitable techniques or tricks to be employed in the close and awkward positions which obviously could not be simulated in the school. At the present time very little of this type of instruction is being employed and the student or newly hired welder, unless experienced in ship construction, may struggle for hours with a difficult position, whereas, five to ten minutes instruction by a competent instructor may solve his difficulty. The results obtained by these practical demonstrations aboard ship have been most gratifying.

The author has in mind several other instances where the usefulness of certain old experienced welders was becoming a question, until they were taken in hand and their faults explained to them. The usual procedure is to assign one or more expert welders to work under the direction of the welding supervisor who may direct them to instruct such men as appear to need it.

(Part 2 of this article will appear in our next issue.)

NOW IS THE TIME TO JOIN THE

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Latest type of all-welded tugboat built by Ira S. Bushey & Sons, Brooklyn, N. Y. Size: 116 ft. long, 26 ft. beam, 14 ft. depth. This sea-going tug, designed for coastwise service, is capable of towing between 5000 and 7500 tons. Accommodations for the crew provide most of the comforts of a luxury yacht. Photo (Ira S. Bushey & Sons).

Slabbing mill at Plant No. 2 of Inland Steel Co., Indiana Harbor, Ind. From here the slab goes to either the 44 in. or 76 in. continuous hot strip mill.

Oxy-Acetylene Welding and Cutting in

Steel Mill Maintenance

★ Plant reclamation work provides repaired parts equal in value to new equipment — Diversity of mill applications outlined — Operations are speeded up and costs are lowered.

By B. S. BURRELL*

General Master Mechanic, Inland Steel Co., Indiana Harbor, Ind.

BEFORE THE ADVENT of oxy-acetylene cutting and welding practice about 1910 we were obliged to handle the welding of machinery parts in our blacksmith shop. Intricate forgings and mostly all castings were repaired by the patching method, such as forging and forming plates or slabs to the broken parts and holding them firmly with bolts, rivets and dowel pins and by the shrinking of forged bands around such sections where the shape would accommodate them. The patching of cracked steam engine and pump cylinders, valve chambers and main bed plates or frames was quite a serious problem and men who could successfully do such work were considered of good value to the steel mill management.

At best most of this patch work was of an unsightly appearance and the patches were calculated in strength very much above the actual strength of the broken parts. This was a common practice in order to play safe against a repetition of breakage at that particular location. Whenever it was possible, broken equipment was taken to the mechanical shops where a much faster and better fitting patch could be applied. However, most of the heavier broken parts were repaired in the field. A shop job could usually be accomplished in one-fourth of the time it took to do the same job in the field when the broken part could be quickly removed from the machinery unit.

Since the advent of welding we are often obliged to clamp and bolt up temporarily a broken part in order to operate until a shutdown can be had to make a welded repair. Thus in many cases the clamping practice is still carried on; in each case the most profitable procedure is followed.

*Condensed from paper presented at 40th Annual I. A. A. Convention, Milwaukee, Wis., April 10-12, 1940.

Blast furnaces and hot air stoves. Ore storage dock in foreground and conveyor bridge for ore unloading from boats. Photo (Inland Steel Co.)

The building up and re-machining of worn machinery parts which could not formerly be done, except by bolting on liners, is today accomplished very easily and at a nominal cost compared to the value of new parts. In our practice a broken or worn machinery part is reclaimed by our Welding Department without special authorization, when the cost of such work will not exceed 50% of the replacement cost, and with due consideration given to its age and service requirements; otherwise special authorization must be had before proceeding with the work.

Reclamation Work

The reclamation of worn and broken machinery parts has been a large factor in lowering our repair and maintenance costs and in most cases provides our mill departments with repaired parts equal in value to new equipment, and in certain cases added strength is provided. Thus welding has taken a very important position in steel plant repair and maintenance work.

Oxy-acetylene welding has played an important part in keeping crane runway rail ends to the proper height at the joints; the hardness of these rail ends after welding is somewhat harder than the parent rail, and thus they hold up longer.

For some years we were not very successful in building up and repairing broken cast-iron castings. However, we are now able to reclaim such parts by the brazing of bronze to cast-iron. This system works out well on steam locomotive parts, such as cylinders, pistons, crossheads, guide slides, shoes and wedges, and many other types of cast-iron machinery parts, such as scale beams, supports and levers, and especially in cases where a steam or water tight job is required. However, there are certain classes of machinery and furnace castings where bronze facings and such welded parts do not stand up against heat and abrasion.

Cast-Iron Procedure

We have had good success in repairs to broken cast-iron castings by first fusing onto each side of the cracked section of castings, a thin layer of special alloy steel and then fusing or welding in mild steel to complete the weld. This practice was first done on sintering plant pallets, the replacements of which were a very heavy cost to the department. We find with this method the welded section is stronger than the original casting. This method is followed in making welds to cast-iron castings subjected to furnace heat and abrasion and where good strength is required.

Oxy-acetylene welding is giving a good account of itself on pipeline work and has contributed well in reducing maintenance costs. All important large and small pipelines are of welded construction today and many of the older installed steam lines are constantly being improved by welding pipes to flanges and valves. In many cases flanges are being removed except at valve connections, thus removing troublesome leaky flange gaskets.

This practice is followed on thousands of feet of water, gas, oil and steam lines, and produces practically a continuous line of jointless piping free from future leakage when properly installed as regards to allowances for expansion and contraction. Large underground main water lines of steel construction are welded throughout.

The combination welding and cutting torch is used by our pipe department, thus providing a single torch for both fitting or cutting of piping to position desired and for making the weld. In most cases brackets, hangers, etc., to support piping are cut and welded into place on the job, thus eliminating the need of designing and manufacturing such parts in our blacksmith and machine shops, as was formerly done at a much greater cost.

Open-Hearth Repairs

The combination torch is also of good value in repairs to open hearth water-cooled doors, frames, dog houses, etc. The burned out or leaky portion is cut out and a plate cut to size and welded in. Thus the article is again ready for use. This class of work is done in the open hearth department.

Oxy-acetylene welding is done on much of our pickling department equipment made of Monel metal and acid-resisting bronze, lead linings in tanks and producing lead electrodes. It also serves us in the manufacture of light gauge Monel and other alloy tanks, troughs, etc.

Oxy-acetylene is used in hard facing welding such as applying Haynes Stellite alloys and like material, stainless steel, etc., to produce hard faces on machinery parts subject to extreme wear due to corrosion and abrasion.

Alloy steel chain welding is another important use for the oxy-acetylene process in our plant. The process is also used by us in the welding of non-ferrous metals such as aluminum castings, copper conductor bars, brass bearings, lead pipe, etc.

The oxy-acetylene flame is used to heat certain small areas of plates, bars, angles, etc., for bending, shaping and the like, and the heating of cold drive fitted rivets for hot heading, and for hundreds

of other heating and shape fitting jobs.

Oxy-Acetylene Cutting

We have distributed to all departments throughout our plant about 225 cutting torches. Following are some of the more important lines of work done:
The cutting of structural steel shapes, plates and slabs to size and shape for structural shop fabrication, and machinery parts formerly made of castings and forgings, such as gearing, pipe flanges, brake wheels, open hearth ladle stands, ladle hooks, table extension brackets, shear knives, ore bucket parts, manipulator sideguards, table roll necks, apron plates, ingot car brackets, annealing furnace spiders, galvanizer pot machine frames, motor bases, and hundreds of other machinery and equipment parts.

Scrap cutting was formerly done by shearing. The shearing of bulky or fabricated structural scrap and certain castings was a dangerous practice and costly from the standpoint of labor charges. Today we buy more scrap in bulk form and maintain a large cutting department which has proven much more profitable than the old shearing and breaking system.

The use of oxy-acetylene cutting of certain machinery and equipment on field repair and maintenance jobs has been the means of speeding up work and lowering the cost.

No. 1 Open Hearth—This department uses for all purposes each year approximately 1,000,000 cu. ft. of oxygen, and 89,000 cu. ft. of acetylene. All of this acetylene is used in maintenance work and about 550,000 cu. ft. of oxygen are used for cutting out furnace tapping holes. This department is supplied by tank service.

No. 2 Open Hearth—This department uses each year approximately 5,500,000 cu. ft. of oxygen, and 620,000 cu. ft. of acetylene. Oxygen is used for repair and maintenance work, scrap cutting and cutting of tapping holes. All acetylene is used for repair and maintenance and scrap cutting. The oxygen for this department is supplied by a "Driox" oxygen system, and acetylene from a calcium carbide generating plant.

Charging an open hearth furnace with molten pig iron taken from the blast furnace. Photo (Inland Steel Co.)

Blast Furnace—This department uses each year 750,000 cu. ft. of oxygen, and 100,000 cu. ft. of acetylene. About 250,000 cu. ft. of oxygen is used in cutting out tapping holes; the remainder of oxygen and all acetylene is used on repair and maintenance work. All material is furnished by tank system.

40-in. and 46-in. Blooming Mills and 44-in. and 76-in. Hot Strip Mills—These departments use per year 25,000,000 cu. ft. of oxygen and 1,800,000 cu. ft. of acetylene, of which 23,000,000 cu. ft. of oxygen and 1,350,000 cu. ft. of acetylene is used for scarfing; the remainder of each are used for repair and maintenance work.

The 40-in., 44-in. and 76-in. mill slab docks do all hand scarfing. However, recently a large edge machine scarfer has been installed on our 46-in. mill between the mill and shears and such work is being done hot and with good success. The oxygen and acetylene for these mills is supplied from a central "Driox" oxygen system and calcium carbide acetylene generating plants.

Amounts used per year, total plant:

8,000,000 cu. ft. tank oxygen 35,000,000 cu. ft. "Driox" oxygen	Grand total—43,000,000 cu. ft.
1,500,000 cu. ft. tank acetylene 1,800,000 cu. ft. Gener. acetylene	Grand total—3,300,000 cu. ft.

We have in our plant 250 oxy-acetylene cutting torches, 225 of which are held by the users and 25 are in our shop for repairs or are being held for exchange. We have in our plant 90 oxy-acetylene welding torches, most of which are of combination construction for welding and cutting operations. Of these, 80 are held by users and 10 are in our shop for repairs or are being held for exchange.

Apparatus Repairs

All adjustments, repairs and maintenance of torches, regulators, hoses and connections, etc., are made by specialized men in the tool department of our main machine shop; such work is not permitted to be done by users. When a piece of equipment is out of order it is brought in and exchanged for first-class (repaired and tested) apparatus.

All classes of welding rods are carried in our main plant stores department and distributed on authorized stores department requisitions. Orders for such material and all welding equipment requisitioned by any department for purchase from an outside agency has to have the approval of our welding supervisor, and when received at our stores department, the material and equipment is checked by the welding supervisor before it is given out to the user.

Welding Shop Organization

Our welding shop supervisor and assistant have direct charge of all shop welding and cutting and indirect charge of all such work done in all mill departments throughout our steel plant. These men make daily trips through the various departments and instruct all concerned about the proper methods of procedure and safe practice.

(Continued on page 39)

Arc welding nozzle to pipe header at Air Ducts Ltd., London. Photo (John S. Trevor)

Review of
Wartime Activities of

British Welding Industry

★ Intensive training programs set up for welding supervisors and operators—All-welded hulls can take as much, if not more, punishment as riveted hulls—Bomb-proof civilian shelters are welded.

By JOHN S. TREVOR

THE GREAT WAR OF 1914-1918 gave welding its first real opportunity, although, strangely enough, it was not seized or exploited with any great enthusiasm. The present conflict represents a most important stage in the development of welding, as the merits of the process are now fully recognized by every branch of the fighting services and generous use is being made of it in naval shipbuilding, the construction and repair of purely military machines, such as tanks, army truck bodies, etc., for civil defense purposes, particularly A.R.P., also in the building of new armament factories and bridges of great strategic value.

It is no exaggeration to say that the entire welding industry has been mobilized. Proof that the Government recognizes the wartime importance of the welder is given by the fact that his occupation is reserved from age 21. The Institute of Welding in Great Britain has worked out a scheme, which is now in full operation, for the training of welding supervisors and operators and more than one prominent welding concern has organized its own private school for training men. Government training centers are also busy training selected unemployed men with the object of absorbing them in the armament industries. A move is also being made to use women in the welding industry for light work, particularly light gas welding.

A Welding Company

In addition to the training of welding operators, the Institute of Welding has undertaken several schemes of national importance. For instance, a scheme has been prepared, with the approval of the Lord Privy Seal, for organizing facilities of welding contractors for the repair by welding of struc-

tures damaged by air bombardment, and this scheme is now in operation. Of considerable interest, also, is the formation of a welding company of the Royal Engineers, which is being recruited largely from members of the Institute of Welding.

This company will include approximately 8 officers and 300 men. The commissioned ranks will be drawn from specialist engineers who have had experience in the strengthening, repair and design of bridges and structures, and also of repairs to heavy machinery. When the present stalemate ceases on the Western Front, this company will be of the greatest assistance to the mechanized units of the B.E.F. Tanks will be repaired only a short way behind the front line and damage to armored cars, convoy lorries and artillery made good on the spot. Army welders will no doubt also be utilized in construction of large storage tanks for fuel, etc., and on permanent fortifications and for laying down of steel tank traps, etc.

Research Work

It is encouraging to note that the Research Committee of the Institute of Welding is continuing its work and that results of investigations will be made known immediately to members and thus be available to industry. Work in progress on the welding of high-tensile (low-alloy) steels and high-alloy steels which possess strong air-hardening properties will undoubtedly prove of the greatest importance to the industry, not only in war time, but when peace is declared and normal industrial requirements have to be met.

One of the most important applications of welding in Great Britain's mighty war effort is to be seen in her naval shipyards. Naval architects are fully cognizant of the fact that welding is not only the most efficient method of joining steel structures, but permits the economy of a considerable amount of steel and thus enables a large proportion of a ship's displacement to be used for purely military characteristics. With welded construction on ships, all attachment angles, bulkhead boundary bars, clips, box corners and angle collars are eliminated, along with costly anglesmith work. Plate laps are reduced in size or eliminated and the metal saved can be redistributed to compensate for corrosion or utilized to increase the carrying capacity of the ship.

All-Welded Hulls

All that has transpired so far in naval warfare has provided evidence that the all-welded hull can take as much, if not more punishment than the normal riveted structure. According to naval experts, one of the lessons of the battle of the River Plate was that the all-welded "Graf Spee" stood up extremely well under the tremendous vibration of her own broadsides and the devastating effect of the British cruisers' guns. Examination of the battered pocket battleship in Montevideo harbor (Uruguay S. A.) has provided unmistakable evidence that the welded joints were intact and that the ship was by no means irreparably damaged.

The official attitude of the British Admiralty towards the all-welded hull is one of watchful caution. The behavior of all-welded and partly welded ships is being carefully noted and new work now in progress is dictated in the light of actual experience. Early in 1939 it was revealed by Commander J. D. Marsh, the captain of the all-welded mine-sweeper "Seagull," Britain's first all-welded warship, that after extensive trials and experience of rough weather conditions, he had nothing but praise for the ship. She could steam faster than the "Leda," a sister ship of riveted construction, and this he ascribed to the saving in weight and the smoothness of the hull.

Multiple-Operator Sets

It is of interest to consider briefly the method and welding equipment used in building the H.M.S. "Seagull," as this is rather typical of present naval practice. The ship was built at Devonport Dockyard, which is equipped with four 30-kw. portable motor-generator sets, converting 380/440 volts a-c. to 50-volts d-c. An average of 20 welders worked on the slip obtaining their electrical supply from junction boxes along the side of the slip. Each welder used his own reactance and resistance on racks beside the ship, or on deck as the work progressed.

Welding Procedure

According to A. Nicholls, R. C. N. C., in a recent technical paper, the ship was welded throughout, except for plating under 5 lb. thickness. Welding was continuous unless intermittent welding was definitely specified. The laps of all plates were welded with a full fillet on one edge of the lap and a light fillet on the other. Strict supervision was exercised in order to be certain that the welding was in accordance with information supplied on drawings. Great care was taken to ensure that all slag was removed from between successive runs of weld metal and from the final run before any painting was done.

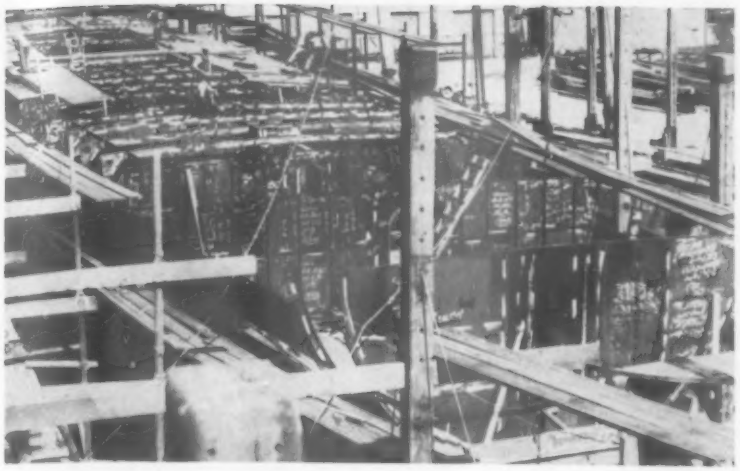
For all continuous lengths of welding, the "step-back" method was used, i.e. alternate runs of weld metal were deposited with gaps between each run. The bulkheads were fabricated in the following way: after tack welding the plates in a few places to keep them in position, the order of welding was (1) butts of plates, (2) edges of plates, (3) stiffeners, (4) boundary angles. The bulkhead was then turned over and the welding of butts, edges and boundary angles completed; where necessary, temporary stiffening was added to prevent buckling during transport.

Sequence of Welding

The system of working outer bottom plating was from amidships towards the ends. The order of welding on each plate, after being securely clamped to obtain close fitting at faying surfaces of frames, longitudinals and laps, was as follows:

1. One butt, preferably that nearest amidships, welded.
2. Plate tack welded at frames, longitudinals and edges.
3. Edges completely welded.
4. Frames completely welded.
5. Longitudinals completely welded.

In regard to deck plating, the butts were welded first and then the



Construction view of upper deck of the all-welded minesweeper H.M.S. "Seagull", Britain's first all-welded warship. Photo (Murex Welding Process Ltd.)

edges of plates. The plating was tacked to girders and beams until the butts and edges were completed.

Aircraft Carrier

One of the greatest advances yet made in the practice of welding in British warship construction was in the building of H.M.S. aircraft carrier "Ark Royal" at Birkenhead. This remarkable ship is 800 ft. long overall, has nine decks and is reputed to be 75% arc-welded. She is one of the longest ships ever built at Birkenhead and, considering her size, the time she was on the stocks constituted a record, since her tonnage is 22,000 tons. This ship, which was designed by Admiralty constructors, is also remarkable in that she has the largest deck surface in the Royal Navy, and the decks are all welded. With respect to the battleships of the King George V. class, statements have been made to the effect that these ships are being partially constructed by arc welding.

Welded Destroyers

It is known that for some years Messrs. J. Samuel White & Co. Ltd. have utilized arc welding, in place of riveting, in construction of several destroyers of the "F" class. The frames of these ships were welded to the floor plates and the lower decks over the main oil bunkers and the bulkheads of these bunkers were also welded. These tanks were tested by filling them with oil. No sign of "weeping" was found anywhere. The builders were of the opinion that such results afford a good argument in favor of electric welding.

The welding of bulkheads and flats bounding the bunkers was done mostly on "skivs," alongside the building berths, and the completed units hoisted into place. This procedure obviated a great deal of overhead welding and was considered an undoubted economy.

The deck edges in these destroyers were welded direct to the shell plating, giving a neat water-tight job at a lower cost. Generally, throughout the ship the knees joining frames and beams were welded, as were practically all of the deck fittings and engineers' pads on watertight bulkheads, ladders, mast tabernacles and small tanks. The bollards were built of plates reinforced.

Electric welding was also used extensively in construction of deck houses and superstructures, and on the light plating of the blast screens, including their supporting girders and brackets.

In peace time it is naturally difficult to test welding which has been incorporated in construction of a warship. The accident to H.M. Destroyer "Hunter" two years ago when she struck a mine while on patrol work in the Mediterranean during the time of the Spanish Civil War, satisfactorily demonstrated the efficiency of British naval construction.

Air Raid Shelters

Turning now from naval to civil defense applications of welding, one of the most interesting is the use of welding in building industrial air raid shelters. A type of blast and splinter proof shelter which meets the Home Office requirements for outdoor protection, where deep shelters are not possible, has steel ribs of rigid-frame type designed as a three-pinned arch, this type being very light in weight, easily transported and erected. Maximum stresses occur at the knee-joint where a simple detail provides a butt-welded joint for the tee bars in compression combined with a cruciform diagonal to resist the components of tension in the outer flange. This flange consists of plain mild steel round bar, 1 3/16 in. diameter. Shear members are also of plain round bars for the two similar portions of the web, with batten plates below for the narrow portion of the leg. The welding of the zig-zag shear member is calculated for increment of stress in the flanges.

Bomb-Proof Shelters

Welding is also used in the construction of bomb-proof shelters able to keep out semi-armor piercing bombs of 300 kilos in weight. This method has been used with great success in construction of all-welded steel cylindrical A. R. P. shelters for protection of key men at generating stations and many other vital industrial centers. These "key men" shelters are individually protected and are splinter-resisting. One popular type of shelter is constructed of ¼ in. steel plate throughout. The height in the center is 6 ft. 8 in. and at the side 6 ft. 2 in. There are bottom ventilation holes and also a ventilator on top of the domed roof. Welded structures are also being made for placing in front of windows of buildings on R. A. F. aerodromes. These structures are filled with sand to give protection against bombs. A considerable number of welded tanks and boilers for A. R. P. use are also in service. The tanks are for storage of water and the boilers are for cleansing of gas-contaminated clothes.

Engineering Acceptance

The speed of construction, economy of man power and saving of metal possible by use of welding is now being more fully appreciated by civil engineers in war-time Britain and, in consequence,

greater use is being made of welding for factory construction, bridges and other vital structures. Although extensive use has been made of welding for bridge construction abroad, British engineers have not shown much enthusiasm for the all-welded steel bridge, although, of course, welding has been used for repairs and strengthening of existing bridges.

In fact, only one body, the London Passenger Transport Board, has adopted what might be termed a truly progressive attitude towards welding and it can boast of the construction of the only two all-welded steel bridges in the country. The second of these was completed only a few weeks ago at Hainault, Essex, and was constructed of mild steel, with exception of phosphor bronze bearings. The steel was in accordance with British Standard Specification No. 153 and electric arc welding was done in accordance with British Standard Specification No. 538. The bridge was designed to carry a load equivalent to 18 units of British Standard loading for railways and in calculating the stresses due to dead and live load, the worst conditions of loading were applied. An allowance of 50% for impact and vibration was added. The maximum working stress was 8 tons per sq. in. in tension (16,000 psi.), with corresponding modification prescribed for compression and a bearing pressure of 20 tons per sq. ft. was allowed on concrete bedstones of abutments.

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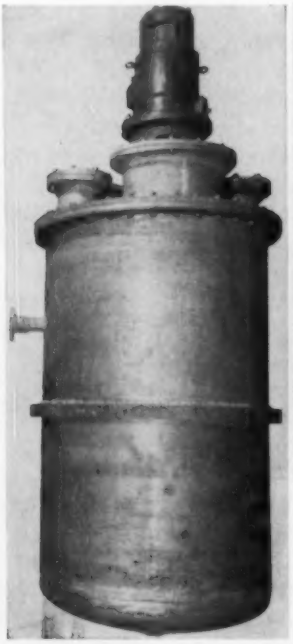
Welding Is Preferred For Corrosion-Resistant Alloys

★ Corrosion-resistant alloys find their greatest application in chemical process and food and beverage industries. Through the courtesy of Chicago Boiler Co., 1965 Clybourn Ave., Chicago, Ill., we present several examples of welded vessels which illustrate how welding is used as an important fabricating tool in building equipment for these processing industries.

In Fig. 1, for example, is shown a welded aluminum kettle for use in the chemical industry. The shell is made from ¾ in. aluminum plate rolled to 36 in. diameter. The kettle proper is 5 ft. deep.



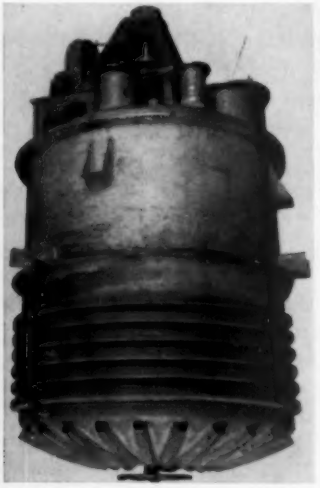


Fig. 1 (left)—Welded aluminum kettle for use in chemical industry.

Fig. 3 (above)—Welded stainless steel varnish kettle of conventional design.

Fig. 2 (left)—Welded stainless steel varnish kettle with provision for electric heating elements.

Fig. 4—Welded steam-jacketed vacuum tank used as a food mixer.

In Fig. 2 is shown a stainless steel varnish kettle so designed that electric heating elements can be inserted into the circular hoods around the bottom of the shell and also into the radial hoods welded to the bottom. This kettle is welded of low carbon 18-8 stainless steel, the shell plates being ⅜ in. thick and the heads ½ in. Kettle diameter is 66 in. and overall height is 6 ft. 6 in.

Figure 3 shows a conventional type of welded stainless steel varnish kettle 60 in. in diameter and 40 in. deep. The bottom plate is one-half in. thick, the mid-section is 5/16 in. plate and the upper section is ¼ in. plate. Has a motor-driven mixer.

A steam-jacketed vacuum tank is shown in Fig. 4. This equipment is

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used for mixing purposes in the food industries and for that reason is tin coated on the inside. The steam-jacketed section will be noted at the bottom of the tank, where inlet and outlet flanges are welded to the jacket. The tank is 54 in. in diameter and 30 in. deep and is welded of 5/16-in. carbon steel plate.

Figure 5 shows a welded circular drum fabricated of 18% chromium steel. This piece of equipment made of heat-resistant alloy, is used for reducing copper oxides as employed in the paint industry. The shell is ¼ in. rolled to 72 in. diameter. Length of drum is 10 ft.

Figure 6 shows a stainless steel water storage tank such as used on the new steamlined railway passenger cars. This is one of a number of such tanks built for the Pullman-Standard Car Mfg. Co. The shell is rolled from 12 gauge 18-8 stainless and the heads are formed from No. 10 gauge alloy of the same composition. Tank diameter is 20 in. and length is 13 ft.

A recent job is a welded stainless steel storage tank built for the purpose of storing alcoholic liquors in a government bonded warehouse. It is fabricated of 12 gauge, 18-8 stainless. Diameter is 46 in. and length 12 ft.

Fig. 5—Welded drum made of 18% chromium steel for reducing copper oxides as used in the paint industry.

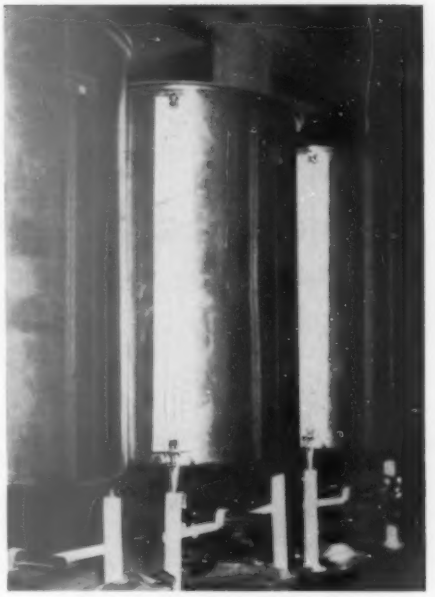
Fig. 6 — Stainless steel water storage tank as used on new streamlined railway passenger cars.

300-Gallon Syrup Tanks Made Of Welded Stainless Steel

★ Sheet Metal Engineering Co., 919 W. 49th Pl., Chicago, fabricates a considerable quantity of stainless steel equipment as part of its general jobbing business. Recently this fabricating shop has built a number of welded stainless steel syrup tanks for the beverage industry. These tanks are made of 16 gauge Republic Enduro stainless steel, 18-8 analysis. A welding electrode of similar analysis is used, usually the 1/16 in. Arcos Chromend K electrode. On some tanks the operator uses a 5/64 in. electrode and a slightly heavier current. Full penetration is secured in one pass from the outside.

In order to aid the finishing operations, these small tanks are designed so that the circumferential weld at the bottom of the tank is located at least 1 in. up from the corner so that the sheets can be butt welded. This has the advantage also of permitting the finishing operator to get at the weld seam with his grinding and polishing wheels. This feature alone has been responsible for a substantial saving in production cost. Generally, a cone-shaped bottom is used with an arc welded radial seam.

The open end of the tank at the top is reinforced with a circular rod, ½ in. or ¾ in. in diameter. Before the stainless sheets are rolled into shape, the end of the sheet is flanged over the circular reinforcing rod and then the two are rolled into shape in one operation. This is made possible by a special groove which has been machined in the bending rolls.

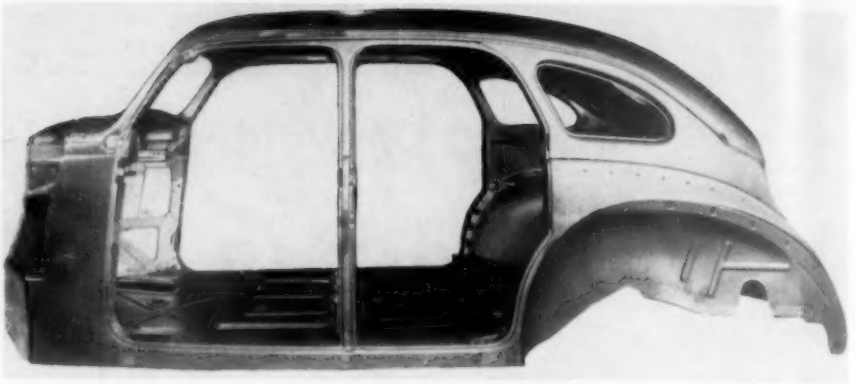


Three of the finished tanks.

This sheet metal fabricator prefers to use flexible shaft tools for grinding and polishing operations. On stainless steel jobs, the finishing costs are considerably greater than the welding costs. This attention to high surface finish is absolutely necessary, however, in order to achieve maximum resistance to corrosion. Following is brief description of the finishing sequences of operation:

Finishing Procedure

First a No. 24 grit size rubber-bonded wheel is used, this is followed in succession by a No. 46 rubber-bonded wheel, then by a No. 46 Neoprene polishing wheel and then by a No. 120 Neoprene polishing wheel. The next operation is carried out with a cotton buffing wheel and polishing rouge. Then before the tanks are shipped, finger marks, grease marks, etc., are removed with Bon Ami. Even this sequence of operations does not produce a surface finish which blends completely with the adjacent sheets. There is a "band" indicating the presence of a welded seam. This contrast "band" could be eliminated but the cost of doing so cannot be justified.



The 1940 Nash body has over 3000 individual spot welds. Semi-portable welding guns are used.

Seaman Body obtains production line flexibility

With Portable Welding Guns

★ Plant engineering department builds equipment of its own design—Series welding of door panels eliminates unsightly indentations.

THERE IS PLENTY of welding to see on a tour of the assembly line in the Seaman Body plant of Nash-Kelvinator Corp., Milwaukee, Wis. Over 3,000 individual spot welds are used to fabricate the 1940 Nash body. The distinguishing feature of these spot welding operations is the exclusive use of semi-portable welding guns built to Seaman Body's own design and specifications. Welding engineers at this plant point out that these guns make it possible to produce 250 to 390 spots per minute on 20 gauge body steel. This means that the timers are adjusted for 2 to 2½ cycles.

The welding transformers are exclusive Seaman design of a nominal 50 kva. rating, but owing to the momentary current flow in spot welding, the safe, instantaneous rating is estimated to be 250 to 300 kva. For example, even at the maximum welding production, a gun is used only about 6 to 8 per cent of the total time, which means that the operating factor of the transformer is only 6 to 8 per cent and explains why a 50 kva. transformer is big enough. Recognition of this important fact has reduced the investment in copper and magnetic sheet used in transformer construction. Glass fiber insulation is used exclusively and secondary coils are water-cooled by means of copper tubing welded around the periphery of each secondary coil.

Primary windings are 440-volt, 60 cycle, and primary curent will average 275 to 325 amps. Maximum primary current is estimated to be 600 amps. Multiple secondary taps are provided so that either 4, 8, 12 or 16 volts can be obtained, depending upon impedance drop in connecting leads.

Surface Cooling

It is pointed out that pure copper is employed for gun anvils and yokes. These are outside surface cooled by the simple method of soldering a copper tube into a machined groove. This construction is claimed to be better than an internally-cooled construction. Welding tips are generally of low-alloy copper.

Welding currents are controlled by Square D magnetic contactors, 150-amp. rating, one in each leg of the primary circuit. Most of the automatic timers are magnetically operated but there are also some electronic timers in the plant. The general method of timer operation is as follows:

1—Time of current flow is adjusted from 2 to 2½ cycles.

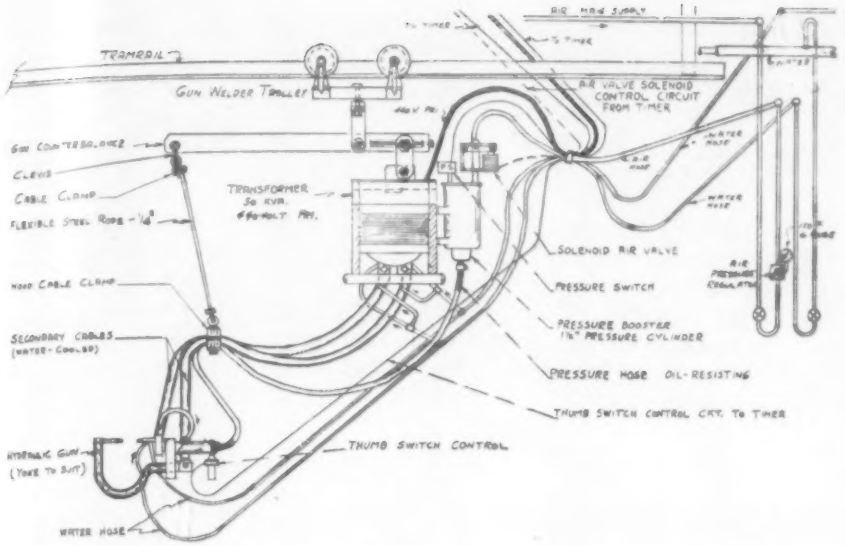


Fig. 1—Typical hydraulic gun welder assembly as used in Seaman Body Corp. plant.

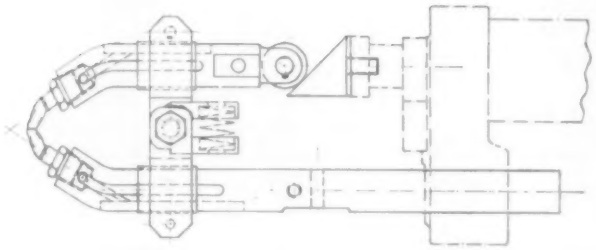


Fig. 2—One type of spot welding gun, using a cam and roller arrangement for transmitting pressure.

2—Current is turned off a definite number of cycles and then cannot be turned on until the welding gun pressure has reached a certain critical value.

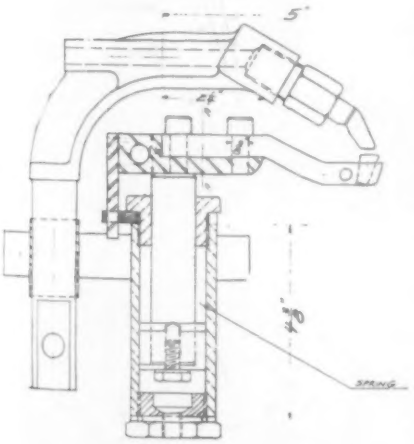


Fig. 3—Type of spot welding gun for welding roof to roof rail.

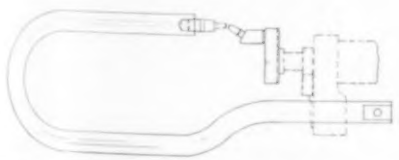


Fig. 4—Long yoke gun used for welding right rear body hinge pillar, and for other operations on 1940 body.

This is controlled automatically by means of a Square D pressure switch located on top of the hydraulic accumulator. A solenoid valve of simple design controls admission of air to the hydraulic accumulator and pressure in the air cylinder is maintained until the proper gun pressure is built up and the welding circuit closed through the pressure switch.

Typical Gun Welder

Figure 1 shows a typical gun welder installation in the Seaman body plant. It will be noted that the transformer and hydraulic gun are suspended from a counterbalance, which is in turn supported from the gun welder trolley which rides on an overhead tramrail. This arrangement enables the operator to bring the gun into welding position and considerably reduces operator fatigue because most of the weight of the gun is carried by the ¼-in. wire rope attached to one end of the counter-balance. It will also be noted that the hydraulic accumulator (pressure booster) is mounted at one side of the 50-kva. transformer. The solenoid valve for controlling admission of air to the pressure booster will be noted on top of the booster. This device is of Seaman design and built in the plant welding shop. The Square D pressure-actuated switch which initiates the automatic timer action is also mounted atop the booster.

Multiplicity of Cables

Hydraulic gun operation requires a multiplicity of cables and flexible hose between the transformer and gun. Biggest of these are the water-cooled secondary cables which carry the heavy welding currents. An oil-resisting high-pressure hose carries the oil from the booster to the gun. Water is circulated to the gun anvil and yoke by means of two rubber hose lines. A rubber-covered electric cable connects the thumb switch control on the gun with the timer. The automatic timer and the magnetic contactors, which make and break the primary circuit of the transformer, are not shown in Fig. 1. They are mounted in steel cabinets on a panel assembly near the welding gun location.

Gun designs are suited to the specific welding job, Figs. 2, 3, and 4 show several designs of anvils and yokes to meet the production problems involved in welding the 1940 Nash body. Fig. 4 depicts a gun design with an extremely long yoke in order to obtain necessary clearance over the work. With a large inductance loop such as this,

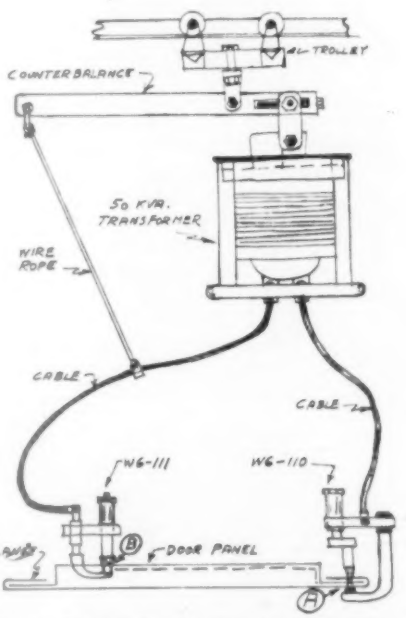


Fig. 5—Schematic diagram to show series welding arrangement for door panels. This eliminates surface indentation at A.

it is necessary to step up the secondary voltage to take care of the greater voltage drop in the circuit.

Series Welding

The problem of spot welding door panels so that no unsightly indentations are left in the outer panel of the door has been licked by the plant engineering department. A series arrangement as shown in Fig. 5 is used to weld the flange between the inner and outer door panels. Instead of conducting the heavy welding current between the top and bottom contact faces of the welding gun (WG-110) the current is transmitted between the top flange portion and the middle sheet as shown at *A* in Fig. 5. The current is carried through the inner door panel to the clamping electrode shown at *B* and then back to the transformer. Owing to the fact that the lower clamping face at *A* has considerable area, there is no indentation made in the sheet. The metal reaches a plastic temperature only in the path of current flow. The lower face at *A* is insulated from the welding circuit.

This series welding arrangement is made possible because of the fact that the transformer has multiple secondary taps permitting either 4, 8, 12, or 16 volts. The voltage must be stepped up as the size of the "welding loop" increases. This arrangement has worked out very satisfactorily and welding speeds are just as high as in the conventional type of spot welding.

Details of the special welding gun for the door flange operation (WG-110) are shown in Fig. 6. It should be noted that the lower element of the gun really carries no current. Details of the clamping electrode (WG-111) are shown in Fig. 7. It will be noted that this clamp is hydraulically actuated in a manner similar to the welding gun (WG-110).

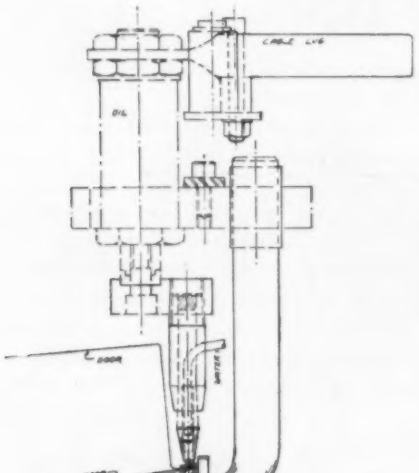


Fig. 6—Type of gun for welding flange on inner and outer door panels (WG-110).

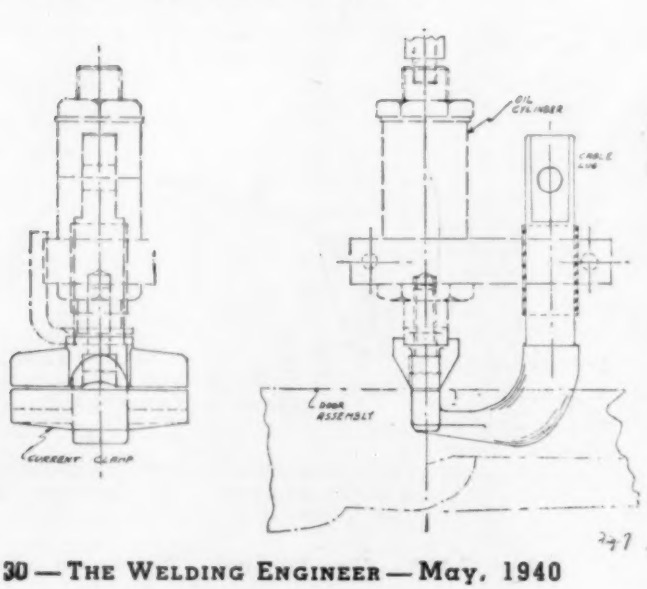


Fig. 7—Details of clamping gun used in series welding of door panels (WG-111).

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Welded Fabrication Makes Highway Trailers Stronger and Lighter

★ Highway freight traffic has made increasing inroads on railroad freight business. The highway freight trailer has played an important part in this competition. The Fruehauf Trailer Co., Detroit, Mich., is a leading manufacturer of these commercial trailers. A riveted design was employed on early Fruehauf trailers, but this has been superseded by the new lightweight welded chassis and welded body framing. As shown in Fig. 1, the chassis structural members are formed from low-alloy high-tensile steel. The circular perforations in the channel webs reduce weight. In this assembly (Fig. 1) arc welders and gun welders are used to fabricate the Fruehauf trailer chassis. The two gun welders are working a short distance behind the arc welders in the foreground. It is reported that the Fruehauf plant in Detroit has the only production assembly line in the commercial trailer industry. In this assembly line, the brakes, angles, springs and supports are later attached to the all-welded base frame.

Fig. 1—Both arc welding and spot welding tools are employed in fabricating the base frame of the Fruehauf "Aerovan" trailer. Welded high-strength alloy steels result in an extremely light unit.

Fig. 2—The body framing features an all-welded tubular strut construction. After body frame is completely welded in this jig, it is then welded to the trailer chassis.

Fig. 3—On this trailer chassis assembly line, the brakes, axles, springs and supports are added to the all-welded base frame.

The body frame of the Fruehauf "Aerovan" features an all-welded square-tubular strut construction. After this body frame has been welded into a solid unit, in an assembly jig, (Fig. 2) it is welded to the trailer chassis by means of portable gun welders. The square-tubular members are box sections which provide both the necessary rigidity and strength to the body framework. These 1½-in. tubular sections are formed from 16-gauge low-alloy high-strength steel. The front end framing of the "Aerovan" is shown clearly in Fig. 2.

A production assembly line is also set up in the new Fruehauf plant in Detroit to assemble the panels, flooring, roof and to install doors, tail gate, etc. The outer sheathing of the body is of 22-gauge steel (Fig. 4). Attachment to the body structure is by means of patented screw fastenings, but an installation is now in progress to permit spot welding of thin stainless steel sheets to the body framing. When this installation is completed, the Fruehauf stainless steel trailer will be truly an all-welded job.

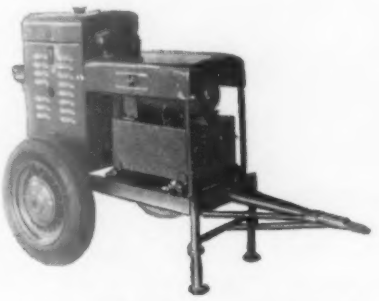
Fig. 4—Panels, flooring, wiring, roof, doors, tail gate, etc., are installed on this body assembly line.

» «

Engine-Driven Arc Welder

★ To help meet the demand for a portable heavy-duty arc welder, economical to operate and of low initial cost, the Comet Products Co. of Chappaqua, N. Y., has developed an engine-driven arc welder. This unit features self-excitation, self-stabilization and simple control.

The heavy main commutator furnishes excitation without use of any external exciter parts. The Comet welder's heavy-duty construction allows use of relatively large size electrodes at high amperages without danger of burning out, it is reported.



Comet engine-driven arc welder.

The Comet welder's simple control of current and voltage permits the operator to select quickly the best possible combination to meet the many varying conditions found in modern welding practice. Adequate marking of controls assures the operator of instantly getting the heat he wants.

The Comet's simplicity of construction and design affords a substantial saving in weight. The welder is offered in four sizes from 150 to 300 amp., either powered by a Wisconsin, four-cylinder, air-cooled engine or by a (300 amp. size) water-cooled six-cylinder Continental engine. All Comet models are also available at slightly higher prices equipped with the Waukesha "Hesselman" diesel engine.

» «

Philadelphia Section A.W.S. — On Thursday, May 16, Philadelphia Section held their annual inspection trip by visiting the plant of **Lukens Steel Co.** at Coatesville, Pa. The Lukens plant boasts of having the world's largest plate mill, 206 in. wide. Lukens also pours the heaviest steel ingots for rolling into these huge plates.

Welding the driving-truck frame. Note that the journal pedestals are set up in a fixture. Photo (General Electric Co.).

Truck and Platform Castings Eliminated in New Locomotives

★ The four Paulista passenger locomotives recently shipped to Brazil are the first heavy main-line motive power units ever built without truck and platform castings, according to O. K. Kjolseth, of the General Electric transportation engineering department, Erie, Pa. The built-up platform and truck-frame structures are particularly notable mileposts in the rapid progress of the welding art. Not only is the structure equal in rigidity to the cast frame, but there are less possibilities of defects and material savings in weight and cost.

Fabrication has been used extensively for a number of years in construction of switching and small industrial locomotives, but the Paulista electric locomotives, the largest direct-current locomotives ever built in this country, have set a record for advances in welding technique.

The utilization of welding in fabrication of large units such as truck frames, cab platform, and cab structure gives not only rigidity, elimination of casting defects, and weight and cost savings, but also additional advantages in manufacturing flexibility which are of considerable importance. In the storage of parts, for instance, the keeping of such large units as truck frames or cab underframes offers a problem. Where a welded structure is relatively small and can be stored where space would not accommodate large finished parts such as frame castings. Welding also permits the building of sub-assemblies in any part of the factory, with the parts brought together later on the assembly floor for final assembly into complete units.

The finished nature of the structural material also permits elimination of certain machine work and, in many cases where machining is necessary, it used, however, the individual parts are can be performed on the individual parts before they are assembled. This eliminates necessity for moving large, heavy parts to be machined, as well as the requirement for special machines to handle such large units.

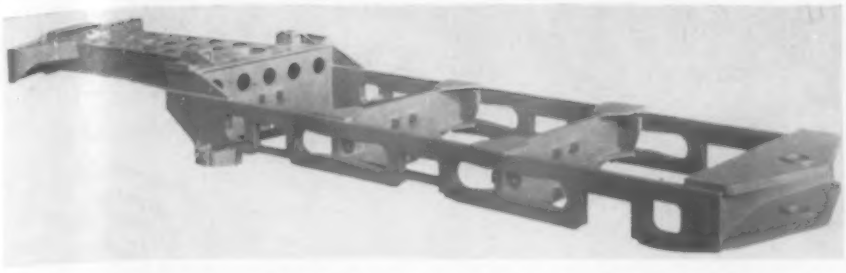
Locomotive trucks, end frames, and miscellaneous parts are welded on this positioning table. Photo (General Electric Co.).

Welded Truck Frames

Successful fabrication of a structure such as the large driving truck frame of the Paulista locomotive calls for considerable welding skill. To facilitate operations, the frame parts are first welded into several sub-assemblies, and these sub-assemblies are then positioned for horizontal welding. They are then placed in a fixture aligned and trimmed to required tolerances, and clamped into position for welding.

Intersection portions of parts to be welded together are preheated to approximately 200 deg. C. A large percentage of these connecting welds are laid in vertically, using a d-c. arc with heavy-coated Type-W22 electrodes. The side-frame pedestal jaws are cut slightly oversize to allow for adjustment of pedestals laterally as well as lengthwise of the frame. All machining operations, such as boring the cab centerplate seat, drilling for articulation pin and brake arm fulcrum, drilling for equalizer and brake-hanger pins, etc., are performed on the individual parts of sub-assemblies before they are welded into the main unit frame.

The side frames of the Paulista main driving truck are universal mill-rolled open-hearth steel, 4 in. thick, normalized. The ultimate tensile strength is 55,000 to 65,000 lb. The



Welded driving-truck frame for G-E electric locomotive (Paulista Railways). Photo (G-E).

Welded guiding-truck frame for same locomotive. Photo (G-E).

maximum carbon content is 0.25%. The articulation end frame and middle cross ties are steel plates, hot-rolled, with 50,000 lb. minimum ultimate strength, and of 0.20 to 0.26% carbon content. Wherever possible, all parts are flame-cut to dimensions requiring little or no machining.

Guiding Truck

The guiding truck frame is also completely welded, using side frames made from steel boiler plates 1½ in. thick with a tensile strength of 55,000 to 65,000 lb. Cross transom, end frames, gussets and stiffeners are made of commercial structural steel shapes and plates of good welding qualities. In the assembly of these trucks, sub-assemblies are set up in a fixture securely positioned and tack welded. The frame is then placed on a universal welding table where flat-positioned final welds are made with heavy-coated Type-W24 electrodes.

Cab Underframe

The cab underframe for this locomotive is one of the most massive single structures yet produced by welding fabrication, it is claimed. The complete structure is about 72 ft. long with two 21-in. H beams forming the main center sills. These beams are reinforced with top and bottom plates of ½ in. thickness, forming a central duct which is used for distribution of air from the blowers to the traction motors. Side sills of 10 in. standard steel channels are welded to the main structure, bringing the total width to a little over 10 ft. Bolsters supporting center plates, side bearings and lifting lugs are built of heavy H beams and plates. The frame is arc welded throughout.

Cab Structure

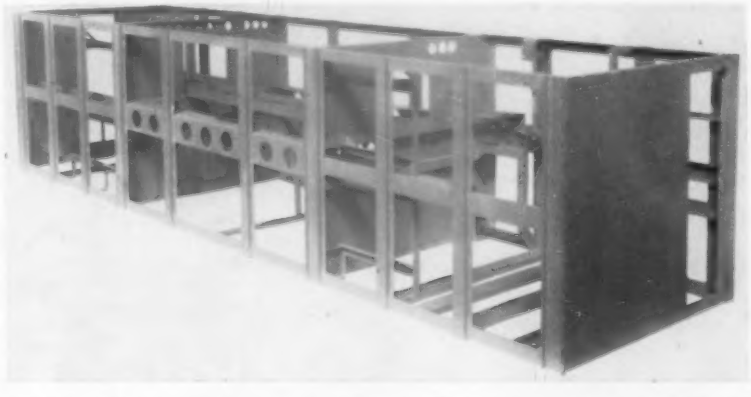
The cab sides are built in sub-assemblies positioned horizontally in a fixture set up on the shop floor. Clamps are used to retain stiffeners or carlines in position while they are being welded to the sheets. The sheets for the rounded ends of the cab are made in sections formed over cast-iron blocks. They are then assembled over a dummy and the seams completely welded.

For the final assembly of the cab, the various sub-assemblies are erected on the cab platform and welded in place. After the cab is completely assembled, all seams are ground smooth on the outside; and louvers, windows, belt rail, roof hatch covers, etc., are given a smooth fit in conformance with the streamlined cab structure.

Apparatus Compartments

A feature of the construction of this locomotive, which is facilitated by use of welding, is the construction of a completely welded apparatus compartment for installation of apparatus, wiring and control equipment. When

Main brake lever, turnbuckle and rods, fabricated by arc welding. An excellent example of small parts made by welding instead of using forgings. Photo (G-E).



Electric locomotive apparatus compartment of welded frame construction. Photo (G-E).

completed, the equipment is placed in position and wired up before the unit is installed in the locomotive. For the final operation the compartment is lowered through the cab roof into its position and securely welded in place.

All brake parts with exception of brake heads and shoes are fabricated by flame-cutting and welding. These parts include the welded main brake arm, adjusting screw and lever connecting rods. Shear welds are used throughout for fabrication of these parts. Another unusual application of welding is in the construction of spring hangers.

» «

Arc Welded Electric Couplings For Marine Service

By LAWRENCE D. JENNINGS*

★ Electric couplings are devices for transmitting torque by means of electromagnetic forces. They do not employ the aid of mechanical contact between the driven and driving members.

Electric couplings are particularly suitable for geared, diesel-engine ship propulsion in marine service. They not only act as flexible couplings to transmit power from the diesel engine to the propulsion gears, but also limit the transmission of torsional vibrations from the engine to the propulsion gears; they act as disconnecting clutches; and are a valuable aid in ship maneuvering operations.

An electric coupling consists of an inner and outer member. The inner member (Fig. 1) is usually mounted on the engine shaft, while the outer member overhangs the gear unit shaft. The outer member consists of a heavy rolled plate to form the rim, a flame-cut web plate, re-inforcing ribs and center hub. Field poles with edge-wound copper windings are bolted to the inner face of the rim. This construction provides a unit having sufficient pole area, ease of accessibility, and simplicity of design.

The mechanical structure of the inner member is similar to that of the outer member, except that a disked-web plate is used instead of the straight-web plate used in the outer member. A laminated core of circular punchings is shrunk to the outer rim. Copper damper bars are placed through this core to form a double-decked squirrel cage winding.

Couplings of this size lend themselves to arc-welded construction, permitting the use of structural plate to secure maximum strength with minimum weight. The hubs are flame-cut from 4-in. plate, the ribs from 1-in. plate, and the webs from 1¼-in. plate.

The web of the inner member is cold formed to the required shape, using forming dies and a 2000-ton hydraulic press. The rim is rolled from a 3-in. mild steel bar and the joint welded to form a continuous homogeneous ring.

Hub, web, and re-inforcing bars are assembled and tacked together, then the ring is shrunk to this assembly. The complete assembly is placed upon a welding manipulator to facilitate positioning during welding and to permit downhand welding with high-speed ¼-in. diameter coated electrodes. This procedure promotes the deposition of high quality weld metal

*Manufacturing Engineer, Generator Works Dept., Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

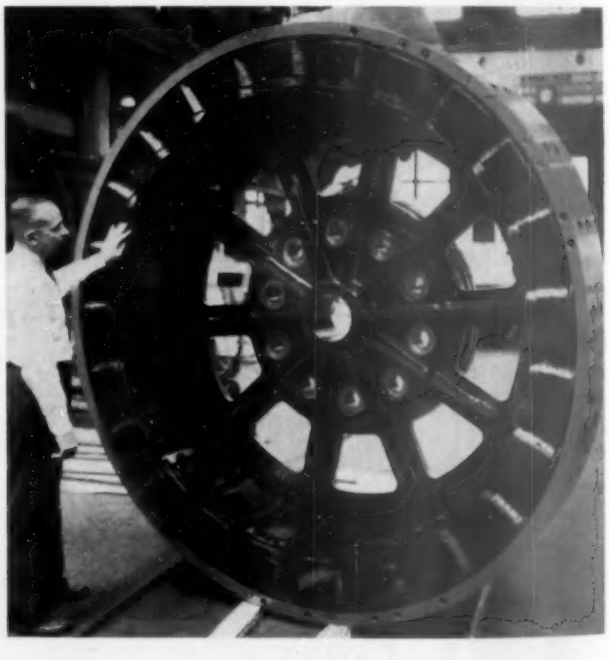


Fig. 2—A straight-web plate is used for supporting structure of outer member of coupling. Openings in web-plates are flame-cut after welding is finished to prevent warping and buckling of web. Photo (Westinghouse).

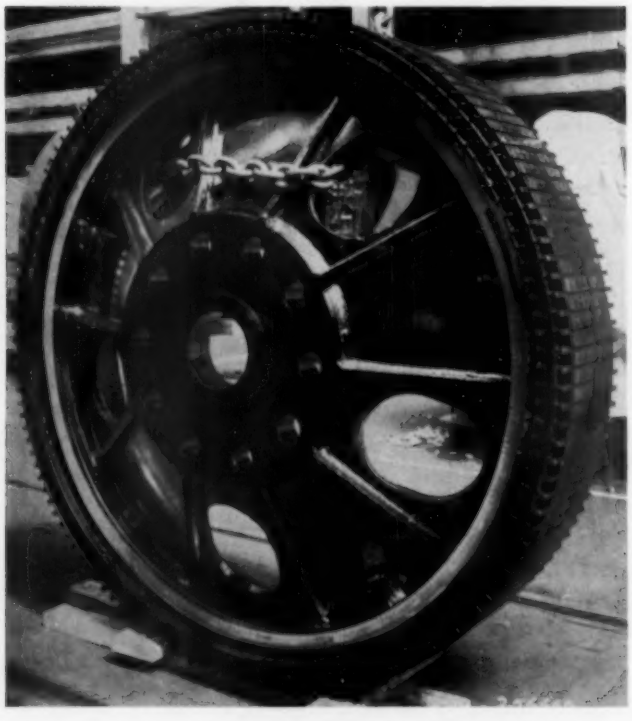


Fig. 1 — Inner member of electromagnetic coupling used for diesel engine ship propulsion. Arc welded plate construction secures maximum strength with minimum weight. Photo (Westinghouse).

having excellent appearance in a minimum of welding time.

The openings in the web plates are flame-cut after the welding operation is finished. This procedure is followed to prevent warping and buckling of the web during welding, because of reduced web strength by the removal of large areas of plate.

Welded assemblies are stress relieved at 1200 deg. F. to remove fabricating and welding stresses. This stress anneal is an economical insurance that the completed member is free of residual stresses and will maintain its "geometry" throughout its service life. Each assembly is shot blasted, thoroughly inspected and is then ready for machining and assembly of electrical windings.

The electric coupling with its simplicity of design readily lends itself to arc welded construction. Arc welding permits the use of low cost, high strength structural plate resulting in an efficient homogeneous, coupling of minimum weight adaptable for marine service.

» «

Western-Austin Building Uses Arc Welded Fabrication

★ A new manufacturing building, the feature of which is a complete absence of roof trusses to provide maximum interior space, was recently completed for Western-Austin Road Machinery Co. at Aurora, Ill. The new building has a floor space of 115,000 sq. ft. and consists of three units.

One unit is a modern up-to-date paint shop 75 ft. by 180 ft. The second unit is a warehouse for storage of raw materials. It is 150 ft. by 250 ft. having three bays; 60 ft., 43 ft. and 46 ft. in width. Two of the bays are equipped with craneways and the third is designed to permit crane installation when needed. The third unit is for product assembly. It is 120 ft. by 500 ft. having two bays; one 40 ft. and the other 80 ft wide. Both bays are served by cranes.

Elimination of roof trusses was made possible by ability to fabricate columns and roof beams which would meet load requirements, without addition of extra members necessary in the conventional roof truss.

Details of columns can be seen in illustrations. The main feature is the top section which is fabricated by welding. This member is not available as a standard rolled section and the costs for riveted fabrication would prevent its use for such a member. It is composed entirely of plate cut to proper size and shape and then welded together. The use of flame-cutting permits economical production of the Y-shaped web segment, while bending equipment is utlized to obtain proper form in flange members. The flange plates are joined to the web of the section by continuous fillet welds on both sides. In production of the columns, these Y-shaped "tree form" sections are arc welded to standard H beams to complete the columns.

These shop-fabricated columns feature a top section made entirely of arc welded steel plate. Photo (Lincoln Electric Co.).

The advantage of this design is reflected in the interior of the building. Roof loads are transmitted from the roof beams in the smooth curving lines permitted in the upper fabricated section of the column. Absence of roof trusses permits installation of craneways in the apex of the roof, thus saving the space which would be taken up in conventional roof truss construction. This feature also reduces structure height and cubical content, which permits lower building maintenance cost for painting and heating.

E. O. Sessions and Co., consulting engineers, Chicago, Ill., designed this structure and erection was under personal supervision of J. H. Johnson, chief structural engineer for the designers. Fabrication and erection was accomplished mostly by means of arc welding, using equipment and electrodes made by The Lincoln Electric Co., Cleveland, Ohio .

Interior of new plant building shows complete absence of roof trusses which provides a streamlined appearance. Photo (Lincoln Electric Co.).

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New Product Developments

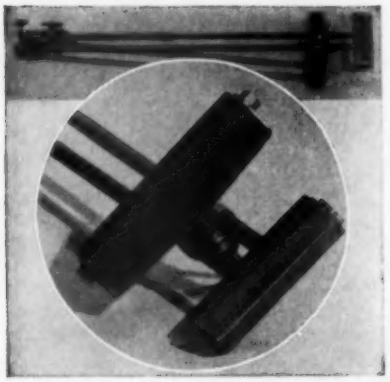


Fig. 1—Special torch designed to flame harden surfaces of rock plant screening plates.

Victor Develops New Torches For Special Purposes

★ The welding torch possesses a versatility far beyond its generally accredited utility value, to weld, braze, solder, hard surface and heat. The three torches here illustrated offer an example of the almost unlimited scope of torch flame application. Figure 1, for instance, shows a torch which was specially designed to flame harden surfaces of rock plant screening plates. The wide roller facilitates torch operation and prevents tilting of the nozzle as it passes over the series of holes in the plate.

Innumerable flame-hardening nozzle sizes and types are required to cover the wide range of flame-hardening and flame-softening processes. Figure 2 illustrates a large, circular, multiple-flame heating nozzle designed primarily to take out buckles in plates by the application of heat. This particular torch type, as here illustrated, has a water-cooled tip and can be provided with integral quenching head.

Figure 3 illustrates one of several types of flame-dehydrating and flame-descaling nozzles. Flame-descaling and dehydrating, while by no means new, are processes which are now more widely employed to remove rust or occluded moisture from structural steel surfaces prior to painting. The nozzle here shown is comprised of removable sections permitting the width of the ribbon of flames to be adjusted to meet specific requirements.

All of these and many similar types of nozzles are manufactured by Victor Equipment Co., San Francisco, Calif., and each of them is designed to fit the standard Victor welding torch butt.

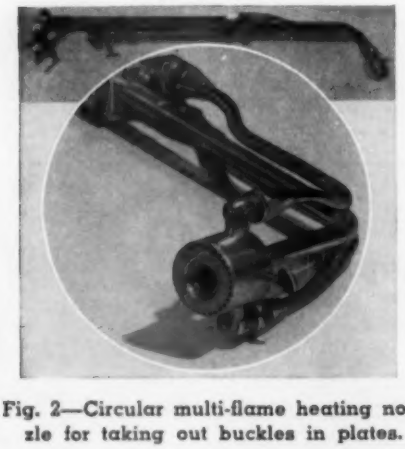


Fig. 2—Circular multi-flame heating nozzle for taking out buckles in plates.

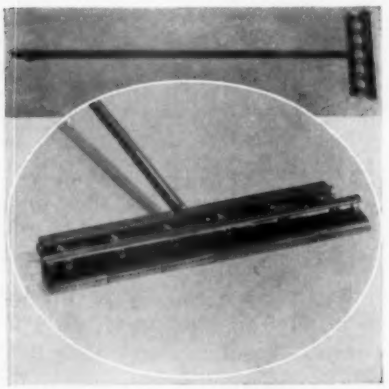


Fig. 3—One type of flame-dehydrating and flame-descaling nozzle.

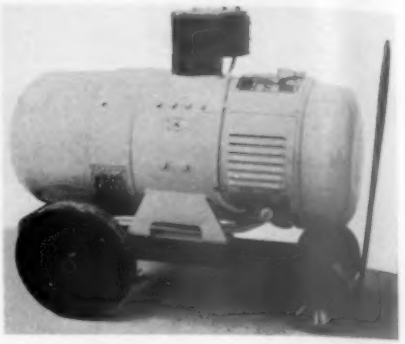
» «

New Remote-Control Device For Wilson "Hornet" Welder

★ A new device for remote-control of Wilson "Hornet" arc welders, has been announced by Wilson Welder and Metals Co., Inc., New York City. The single control of the "Hornet" is well adapted to operation by this method. To utilize the new device, the handwheel which governs the control pole of the standard welder is simply replaced by the reversible motor-driven Type SC remote-control device.

Said to cover the entire range of the machine, the new device allows minute adjustments in current output by merely touching one of two contacts on the electrode holder to the ground. In other words, when the electrode holder button marked "more" is brought into contact with the ground, the electric motor in the remote-control housing on top of the machine revolves and raises the control pole core, increasing the output. The motor revolves only while actual contact is maintained. When the button marked "less" is grounded, the remote-control motor revolves in the opposite direction and lowers the control pole core, decreasing the output. The contact buttons are shaped differently, so that the operator can easily locate the correct one even in poor light.

The 1/80 hp. electric motor, which is all that is necessary to operate the control pole, is protected by two limit switches and by a slip clutch to prevent damage when the end of the range is reached. The generator may be preset by push buttons mounted on the control itself.



Type SC remote-control device mounted on Wilson "Hornet" arc welder.

Further information about the new Type SC Remote-Control Device may be obtained from Wilson Welder and Metals Co., Inc., 60 East 42nd St., New York City.

» «

Welding Helmet Has Hinged Lens Holder

★ Keeping pace with progress in the art of welding calls for improvement in protective equipment for operators. Such an advance was noted recently in the introduction of a welders' helmet made of a new material that effectively insulates against heat and weighs only 15 oz. complete with lens and holder.

Lift-front types are offered which give the operator a dense lens in the outer holder and a clear lens, or less dense lens set in the inner holder. This type of holder requires spring or friction hinges that will hold the raised front

Sellstrom helmet has hinged lens holder.

firmly in position. In the new Sellstrom Type "AA" Lens Holder, the inner and outer frames have concealed spring hinges which allow the outer holder to be raised or lowered in accurate positions. This type of holder is not riveted to the helmet. It is interchangeable and is held in position by two screws.

The new helmet and hinged lens holder is manufactured by Sellstrom Mfg. Co., 615 No. Aberdeen St., Chicago.

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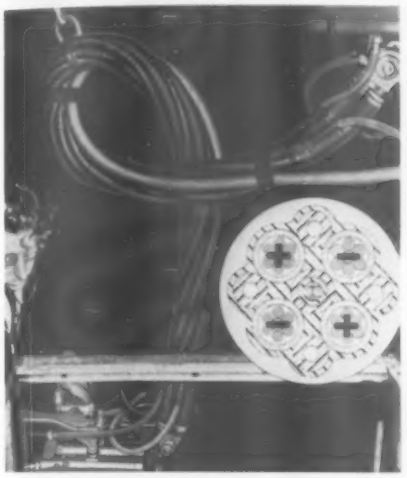


"No-Kik" all-in-one welding cable employs induction-neutralizing principle.

New Welding Cable Utilizes Induction-Neutralizing Principle

★ A new type "all-in-one" welding cable employing a new method of neutralizing induction to eliminate "cable kicking," to reduce welding current losses, to permit increased ease (and speed) of gun handling and to eliminate cable wear is announced by Progressive Welder Co., 3033 E. Outer Drive, Detroit, Mich.

Due to its unusually compact design, the new unit, known as the "No-Kik" welding cable, eliminates interference with work to a large extent. Welding current cables, water cooling lines and control cable are all sheathed in a single, seamless rubber covering of maximum flexibility.

Instead of the customary two secondary cables, the new "No-Kik" has four cables. The method of arranging the duplicate positive and negative cables is said to neutralize each others' magnetic field. This results in less wear (through "cable kicking") and a 60% reduction in welding current costs, it is reported. At gun and transformer ends, each pair of positive and negative cables are joined together to provide a single bolt, solid attachment. The seamless rubber covering maintains cables in their proper relative position.

Currently offered in 250,000, 400,000 and 750,000 cm. capacities and in 6, 8 and 10 ft. lengths as standard, with other capacities and lengths available on special order, the units are recommended especially for use with Progressive guns and transformers, but may be supplied with special adapters for any gun welder-transformer combination.

» «

Goggle Protection for Those Who Wear Glasses

★ American Optical Co., Southbridge, Mass., reports that its No. 323 Duralite Coverglas goggle has been specially developed to provide dependable, comfortable protection for gas welders who must wear glasses for correction of vision. This goggle fits snugly over any style of spectacle, and protects the eyes from flying sparks, scale and welding glare.

The goggle is lightweight, and fitted with Noviweld lenses, to protect against glare and invisible infra-red and ultra-violet rays that may cause "hot sand in the eyes." Other features include improved ventilating louvers that keep eyes cool and lenses clear, yet exclude light; and specially shaped eye-cups made of a durable composition, strong and moisture-proof, and a non-conductor of heat and electricity.

» «

Universal Welding Machine

★ The Eisler Engineering Co., Newark, N. J., has recently developed a Universal Spot Welding Machine (Universal Welder No. 310). This new type of spot welding machine is similar to a Standard 10-kva. spot welder with sliding horns especially adaptable for all kinds of sheet metal work.

This single machine can be used for spot welding, push welding, gun welding and arc welding. This combination unit embodies the following features:

1. Conventional type spot welding machine, foot-operated.
2. A-C. transformer type arc welding machine.
3. Hand-operated push spot welder.
4. Air-operated gun welder.

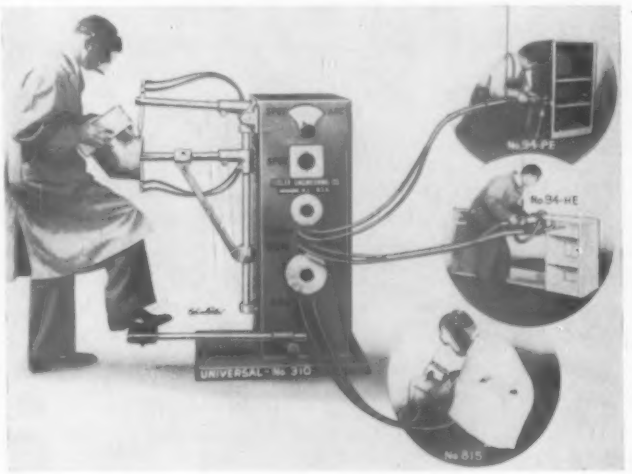
The spot welding machine can also be had for air-operation. Equipment is made for 25-40-50-60 cycles, 220, 440 or any other voltage. The machine is supplied with individual controls so that each operation can be performed without interfering with the other. This combination arrangement is available with a spot welder rating of 10, 20, 35 or 50 kva. Arc welding capacities will range from 200 to 400 amp.

» «

300-Amp. Greyhound Arc Welder

★ Greyhound Electric Mfg. Co., Inc., 31 Grand St., Brooklyn, N. Y., has added a 300-amp. industrial arc welder for continuous welding. They also announce that they are now using General Electric asbestos-insulated wire and asbestos insulation in all their new models. They have extended their guarantee to a 5-yr. period. The complete line of Greyhound arc welders consists of four light-duty models and the 300-amp. industrial model. Jobber's and distributor's inquiries are solicited.

300-Amp. Greyhound Arc Welder



Eisler Universal This versatile machine can be used for spot welding, gun welding and arc welding. Eisler Universal welder No. 310.

Newly-elected officers of the International Acetylene Association—Herbert F. Reinhard (secretary), Henry Booth (president), and Ellsworth L. Mills (vice-president).

These Men Now Directing International Acetylene Association

Henry Booth

"Live and Learn—Die and Forget," is the philosophy of Henry Booth, newly elected president of the International Acetylene Association, and vice-president of Shawinigan Products Corp.

His first job with the T. B. Rayl Hardware Co. in Detroit, taught him how to wrap bundles—a feat of which he is inordinately proud. Then came the Ford Motor Co. which sent him to Newark. A year with the Cheltenham Advertising Co., and then the Canada Carbide Sales Co.—now known as Shawinigan Products Corp. Next July Henry Booth will celebrate his Silver Anniversary of "Life With Carbide."

When not on the road, "Henry" lives in Westport, Conn., with his wife and two children, in a house dating back close to 150 yrs. He takes an active part in the community life and has just been elected president of the local chamber of commerce (membership 299) for the fourth year. He is Junior Warden of Christ Episcopal Church and a Director of the Y.M.C.A.

Henry likes softball, scotch and sodas, puttering amongst roses, traveling, his Dachshund "Miss Essie Widgens," a good game of bridge, cheeses, first editions and delights in selling Shawinigan Carbide.

Ellsworth L. Mills

Ellsworth L. Mills is a director and vice-president of The Bastian-Blessing Co., Chicago, Ill., manufacturers of the Rego line of welding and cutting equipment. He was born in Denver, Colo., and received his B.S. degree in civil engineering from Cooper Union Institute. He is well known throughout the industry as "Rego Mills" but more affectionately among his immediate associates as "The Colonel." His most-oft used expression is "Did you get the order?"

From 1905 to 1913 he was assistant engineer in charge of purchasing for the New York Central Railroad, Grand Central Terminal Improvement. Following this, and until 1917, he was consulting engineer to the New York Subway Commission in charge of designing and construction of all subway and elevated track work. In 1917 he became manager of the railway supply department for Dilworth-Lockwood. This work was interrupted by the Federal Railroad Administration in 1918 due to the World War, at which time he accepted the position of sales manager of Air Reduction Co. in New York, where he remained until 1920, when he became affiliated with The Bastian-Blessing Co.

Mr. Mills has contributed numerous technical papers to the industry, as well as inventions in precision gas pressure-regulating equipment. He is a director of the International Acetylene Association, the National Oxygen and Acetylene Association, and the Liquefied Petroleum Gas Association.

With all of the above activities, his cranial resemblance to Henry Booth, president of the International Acetylene Association, is not surprising. Indeed, he is a notoriously hard worker and finds it difficult to squeeze in time for outside diversions. In fact, to borrow his own words, his chief hobby is "more work," rock gardening, landscape gardening, hunting for time to go hunting, and engaging in those sports dearest to the hearts of his children.

Herbert F. Reinhard

Herbert F. Reinhard, an engineer with Union Carbide Co., New York City, was reelected secretary of the International Acetylene Association for the ninth consecutive year. "Herb" is well known in the acetylene industry. He is a graduate of Purdue University with a B. S. degree in chemical engineering. During the World War he served as a commissioned officer in France with the United States Coast Artillery. Following the World War, he joined the Indiana State Board of Health as a chemist. Two years later (1922) he joined the engineering department of the Prest-O-Lite Co., Indianapolis, Ind., transferring to the J. B. Colt Co. in 1925. He later became chief engineer of the latter company, which was absorbed in 1931 by the Union Carbide Co.

Oxy-Acetylene Applications, Steel Mill Maintenance

(Continued from page 22)

An assistant or shop foreman is constantly supervising the work being done in the welding shop. When operating full we use 30 welding operators on all classes of welding in the shop system.

When new men are employed they are trained in shop welding and are supplied from this point to the various mill departments, whenever they need extra men or permanent replacement operators. By this procedure all new employees are checked closely on merit and general suitability for such work and learn fully our working policy in such work, including the safe manual handling of tanks, torches and all attachments.

Acetylene Generating Plant

Acetylene gas is piped from two medium-pressure acetylene generators located in a special building. There are two generators in this building having a capacity of 500 lbs. of calcium carbide and 500 gallons of water each. Each generator is capable of generating 1000 cu. ft. of gas per hour. A pressure of about 13 lbs. is maintained in the line and the pressures in the two generators are so regulated that when one generator is empty the other will automatically cut into service. One pound of calcium carbide makes approximately 4½ cu. ft. of acetylene gas and after the calcium carbide is used, the residue flows down into a concrete pit. One charge of 500 lbs. of calcium carbide produces approximately 480 lbs. of lime. A suitable pump is used to pump the lime slush into a disposal car.

Now Is The Time To Join
AMERICAN
WELDING
SOCIETY

It's Time Out for Free Lunch at "Whitey's"—Busy people get hungry and if they are working for "Whitey" Maurath of Maurath, Inc., 7309 Union Ave., Cleveland, Ohio, manufacturer of stainless and heat-resistant welding electrodes, they need not go far for a snack. "Whitey" keeps the company refrigerator amply stocked at all times so that his small army of employees can satisfy that hunger urge immediately.

Readers' Question Box

A Chance To Make $5

In this issue we are repeating our "Readers' Question Box" for the purpose of helping our readers solve some of their difficult welding problems. Whenever such problems of general interest are encountered, we shall be glad to have readers submit questions for this department. In this way other readers of The Welding Engineer will have an opportunity of submitting solutions. We will pay $5.00 each for the best replies received and accepted for publication. All replies submitted should be extremely brief, approximately 300 words in length.

Cracked Fillet Welds Caused by Shrinkage Stresses

In welding heavy slabs, 3 to 6 in. thick, with carefully machined surfaces, usually in the form of a T connection, using ⅜ or ½ in. fillets, we too frequently encounter cracked welds. Apparently the trouble is due to shrinkage stresses set up by the inability of the heavy slabs to yield sufficiently to prevent cracking. The material is ordinary low carbon structural steel welded with a mild steel coated electrode.

What type of welding procedure will eliminate this cracking of welds? The average length of these welds is 3 ft. (W.N.M.)

News of the Industry

Output of Steel Welding Wire at New Peak—Production of steel welding wire in 1939 rose to the record-breaking total of 183,436,000 lbs., according to information received by the **American Iron and Steel Institute.** Welding wire output in 1939 represented an increase of 56% over the 1938 figure of 117,395,000 lbs. and was 18% greater than production in 1937 of 155,310,000 lbs., the highest total previously recorded.

Between 1932 and 1939 the production of steel welding wire rose 760%, more than double the increase in total amount of steel produced during the period. Reflecting the more extensive uses of welding processes, particularly by manufacturers of products in which steel is used, more than 5 lbs. of welding wire were produced per net ton of finished steel last year, compared with 2.6 lbs. in 1932.

» «

A.S.M.E. Will Hold Three 1940 Semi-Annual Meetings—For the first time in the history of **The American Society of Mechanical Engineers**, the 1940 Semi-Annual Meeting will be held in three cities at the same time. With simultaneous meetings taking place in Milwaukee, Wis., at the Hotel Pfister, June 17-20; in Ann Arbor, Mich., at the University of Michigan, June 20-21; and in Asbury Park, N. J., at the Berkeley-Carteret Hotel, June 19-22; more members will be afforded an opportunity to attend one group of technical sessions and to take part in the attendant social functions, according to **Erik Oberg**, chairman of the A.S.M.E. Meetings and Program Committee.

Two technical papers dealing with welded fabrication of machine bases and industrial hard-facing applications are scheduled for the Wednesday and Thursday sessions of the Machine Shop Practice Division. On June 19 **F. O. Volz** of Lakeside Bridge and Steel Co., Milwaukee, Wis., will describe "Electric Welded Construction for Columns and Bases in the Machine Tool Industry." On June 20, **E. E. Levan**, vice-president, Haynes Stellite Co., Kokomo, Ind., will present a paper "Hard-Facing—A Process for the Mechanical Engineer."

R.W.M.A. Announces Contest Rules For Resistance Welding Technical Papers

The Resistance Welder Manufacturer's Association announces a prize contest for technical papers on any subject of resistance welding. This contest is open to any member of the American Welding Society and also to any person living in the United States or Canada, whether or not he is a member of the Welding Society.

The following rules will govern this contest:

1. The contest is open to anyone, without restriction, from the United States, its possessions, and Canada.

2. The contest opened April 1st and will close midnight August 31, 1940.

3. There will be 7 prizes as follows:

One $300 prize
One $200 prize
One $100 prize
Four $ 25 prizes

4. All papers submitted in the contest become the joint property of the R.W.M.A. and the American Welding Society, who will retain all rights thereto.

5. The American Welding Society will appoint three judges, who will judge the relative merits of the various papers submitted and make the awards. The decision of the judges will be final.

6. Papers will be judged on the following basis:

(a) Educational value .....30 points
(b) Fundamental or research value .....30 points
(c) Practical application .....25 points
(d) Presentation .....15 points

Minimum length requirement — 2500 words.

Any paper to be worthwhile must have a very definite educational value. By this is meant that the paper must be educational to The operator, The foreman or set-up man, The designer or engineer, The process or development man and The plant owner or management.

The paper doesn't need to cover all of the educational range shown above. The maximum points may be earned in any one of these classifications.

The paper must have value along the lines of fundamental information or research information. This may be interpreted as being along such lines as set-up values for various welding machines and materials, information which will promote and further the use of existing welding equipment. Research value may be interpreted to include new methods, new economies, data and product design, adapting products to resistance welding, etc.

Any paper to be worthwhile must have practical application and not be a comprehensive theoretical presentation whose practical value is in doubt. The paper should be applicable either to equipment or methods now in use, or to equipment and methods which can be immediately put into use. Naturally, any paper covering a large field of operations, such as, for instance, automotive manufacturing or sheet metal industry, should receive higher recognition than one which is confined to a very limited field, where possible return to the industry would be much less.

The paper must be well presented with concrete facts wherever possible, tables, charts, photographs, etc. The arrangement of the paper should be such that a minimum amount of editing is necessary. Obviously, any paper that is accompanied by photographs, charts, etc., is much better than one without these details.

7. All papers must be typewritten, single-spacing, written on one side only of blank white paper. Photographs, charts, graphs, etc. may either be attached directly to the copy or may be detached, in which case they should be clearly identified with Fig. No's., captions, etc.

8. All papers are to be submitted to:

Resistance Welding Contest
American Welding Society,
33 West 39th St.,
New York City.

9. Further information may be had upon application to **Resistance Welder Manufacturer's Association,** 505 Arch St., Philadelphia, Pa., or to **American Welding Society,** 33 West 39th St., New York City.

Personals

Louis M. Benkert has been named general manager of **Progressive Welder Co.,** 3036 East Outer Drive, Detroit, Mich. Mr. Benkert has been associated with Progressive Welder since its organization in 1935. Prior to his connection with Progressive Welder, Mr. Benkert was assistant to **Fred Johnson** president of Progressive Welder Co., when the latter individual was in charge of welding operations at one of the Detroit automobile plants. Mr. Benkert has been in charge of the service, engineering, estimating and sales departments successively, prior to his recent appointment as general manager.

Louis M. Benkert

» «

John J. Crowe, formerly manager of the Apparatus Research and Development Department of **Air Reduction Co.,** has been appointed assistant to **Herman Van Fleet,** vice-president and operating manager. Mr. Crowe will direct activities of the Apparatus Research and Development Department and will coordinate these activities with similar activities for **Wilson Welder and Metals Co., Inc.** In addition, he will handle apparatus patent matters for Mr. Van Fleet.

John J. Crowe

H. E. Landis, Jr., formerly assistant to Mr. Crowe, has been appointed manager of the Apparatus Research and Development Department. In another Airco change, **C. G. Andrew** has been appointed Manager of Gas Plants.

» «

Frank J. Schuman

Frank J. Schuman has been appointed works manager of the **Federal Machine and Welder Co.,** Warren, Ohio. Mr. Schuman is a graduate of Lehigh University in mechanical engineering and is reported to be well qualified for his new duties, having had excellent experience in industrial engineering, manufacturing and administration.

Prior to joining the personnel of "Federal," Mr. Schuman was associated with

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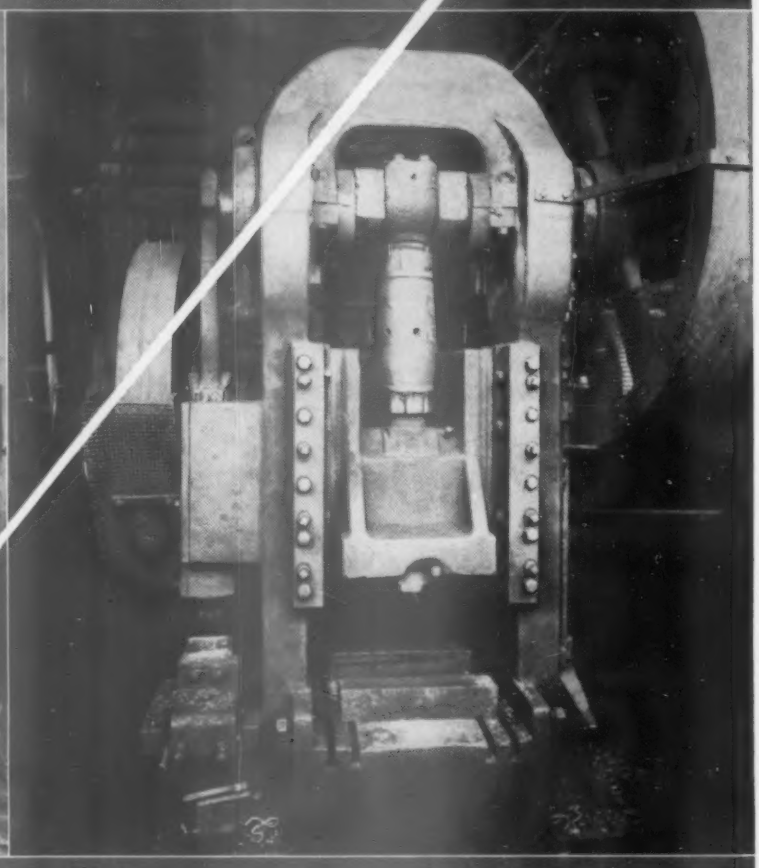


IN 46 HOURS!

Thanks to Anaconda 997 Low Fuming Welding Rod

WHEN the Hebeler Welding Company of Buffalo, New York, were called in on this emergency job, they took one look at the fractured 4½-ton punch press; promptly recommended repair welding with Anaconda 997 Low Fuming Rod . . . a high strength, tough weld metal with low fuming characteristics.

The job consumed 160 pounds of filler rod and 1,600 feet of both oxygen and acetylene. Chipping, preheating with natural gas and compressed air and other preparation required 35 hours; welding, 11 hours. The result was a strong sound weld and a happy production manager, for the downtime loss was only a fraction of what he expected.

Next time you're faced with a similar emergency, bear this story in mind. Anaconda Rods are produced in an extensive line of alloys for all kinds of welding. You can obtain them from your jobber. 40119

ANACONDA from mine to consumer

Anaconda Welding Rods

THE AMERICAN BRASS COMPANY, General Offices: Waterbury, Connecticut

In Canada: Anaconda American Brass Ltd., New Toronto, Ont. • Subsidiary of Anaconda Copper Mining Company

the Standard Tube Co. of Detroit as works manager and previously thereto with the S. R. Dresser Mfg. Co. of Bradford, Pa., in the capacity of plant superintendent.

» «

Chester H. Lang, manager of **General Electric's** advertising and sales promotion activities since 1932, has been named manager of apparatus sales and vice-chairman of the Company's Apparatus Sales Committee. The apparatus (or capital goods) lines range from big turbines to tiny motors.

As advertising manager, and a member of both the apparatus and appliance sales committees Mr. Lang has been intimately associated with all commercial activities of the company. He organized its market research bureau in 1932, a section devoted to sales analysis of existing and contemplated products.

» «

Robert S. Peare, president and general manager of the **Maqua Co.,** a large printing and engraving concern affiliated with **General Electric** in Schenectady, N. Y., has been named manager of the publicity department of the **General Electric Co.** He succeeds **Chester H. Lang,** who has become manager of apparatus sales for the company. In his new position Mr. Peare will also serve as manager of broadcasting for the company with responsibility for operation of its radio stations.

Mr. Peare, a native of Bellmore, Ind., entered the employ of General Electric as a student in the accounting department, two months after graduating from University of Michigan in 1922. The following May he was transferred to the advertising department, where he remained until September 1, 1923, when he returned to the statistical section of the accounting department and a year later

Robert S. Peare

became assistant to the chief statistician. In October, 1926, he was elected secretary-treasurer of the Maqua Co. and three years later became general manager. On January 1, 1934, he was elected president and has continued to fill these positions to the present time.

Features which assure SUPERIOR WELDING QUALITIES of

TITAN BRONZE WELDING ALLOYS

Use of Purest Raw Materials Obtainable, such as Electrolytic Copper 99.96 in purity and Electrolytic Zinc 99.99 plus.

Strict Laboratory Control; Uniformity of Mixtures and Casting Temperature.

Double-Deoxidation Process which eliminates injurious gases.

Penn Bronze—is a general purpose rod. It is low melting (1620° F.) and tins easily and uniformly on galvanized, malleable or wrought iron as well as steel, brass, bronze and any other non-leaded metal with a melting point above 1850° F. It makes tough high-strength welds of high ductility, immune to strain hardening and with great abrasion and corrosion resistance.

Titan Manganese Bronze—is used where both hard and tough welds are desired. Although this is a general purpose rod, it is especially recommended for cast iron. It is free flowing and gives extremely dense, non-porous welds.

Titan Bronze—is a tin bronze with uses and characteristics similar to the manganese alloy; penetrates seams and crevices readily.

Submit your particular bronze-welding problem for solution by our engineers. Recommendations gladly forwarded, together with generous sample for trial in your own plant.

TITAN METAL MANUFACTURING CO.

Bellefonte, Pennsylvania

Trade News

1940 National Metal Exposition

The 1940 National Metal's Congress and Exposition scheduled for Public Auditorium, Cleveland, Ohio, the week of October 21 has already exceeded in space reservations the entire floor space occupied at the Chicago Show last year. This represents the largest advance space reservation in the history of the Society's twenty-two expositions. On February 19 a floor plan and reservation blank were forwarded to all previous exhibitors and they were requested to indicate to headquarters their choices of location, and were informed that spaces would be assigned by the committee as soon as possible after April 6.

Reservations began to arrive immediately, and on the closing date requests had been received for over 86,000 sq. ft. of space. This amount is in excess of the total amount sold at the Chicago Show last year, and a greater amount of space than was provided for in the layout of the Cleveland Auditorium.

Consequently it is impossible for the Committee to assign space at this time, as it will be necessary to lay out additional exhibit space in the Auditorium and then permit all previous exhibitors to have an opportunity to make new

selections (if they so desire) including the newly laid out space. There will be plenty of show space available in the Public Auditorium—up to 150,000 sq. ft. —but the amount of space originally laid out was in accordance with the size of previous expositions.

» «

Westinghouse Business Is Good—A. W. Robertson, chairman of the board of **Westinghouse Electric & Mfg. Co.**, reports that net income for the first three months of 1940 was $4,041,429, compared with $2,356,151 for the similar 1939 period, an increase of 72%. The business of the company is excellent, all plants are busy, most of them working full time. The backlog of unfilled orders of $82,637,841 is one of the largest in the history of the company. The comparable figure for March 31, 1939, was $46,924,240.

A steady rise in incoming orders continues, new bookings for the first three months of 1940 amounting to $65,250,169, compared with $50,120,832 for the same period in 1939, an increase of 30%.

» «

Progressive Welder Has Completely Modern Plant—With the biggest backlog of orders in its history, Progressive Welder Co., designers and manufacturers of resistance welding and hydraulic punching equipment, has begun production in its new, "streamlined" office and factory at 3060 East Outer Drive, Detroit, Mich.

In marked contrast to the old Piquette Ave. mill-type plant, which was at one time devoted to the manufacture of some of the earliest automobiles and occupied by Progressive Welder since its organization in 1935, the new plant, of strictly modern design and layout, has the greater portion of its 30,000 sq. ft. of floor space divided into three main manufacturing departments. These are laid out for production of (1) automatic spot welding equipment, (2) hydraulic punching and riveting equipment and (3) a gun department for manufacture of portable spot welding equipment.

» «

Welders Supply & Repair Co., 510 E. 18th St., Kansas City, Mo., has recently been appointed distributor in the northern half of Kansas for **General Electric Co.** arc welding equipment, electrodes and accessories. **Walter J. Hohenschild, Francis X. Hohenschild** and **Charles W. Rambo** are the key men in this sales agency.

» «

Chicago Welders Witnessed Non-Ferrous Welding Developments — A general welding demonstration was conducted for welders in the Chicago area on May 16-17, 1940. Welding engineers of **The International Nickel Co., The Aluminum Co. of America, Revere Copper and Brass Co.**, and **Handy & Harman**, took part in the actual welding operations at the "clinic."

Demonstrations covered the latest developments in welding technique as applied to nickel and high-nickel alloys, brass, copper, aluminum and

ALL THESE TUBES BRAZED with only 2 ounces of . . . EASY-FLO ! (U.S. Patent 1,899,701)

THIS refrigeration condenser is a typical example showing why so many manufacturers are finding EASY-FLO brazing so economical.

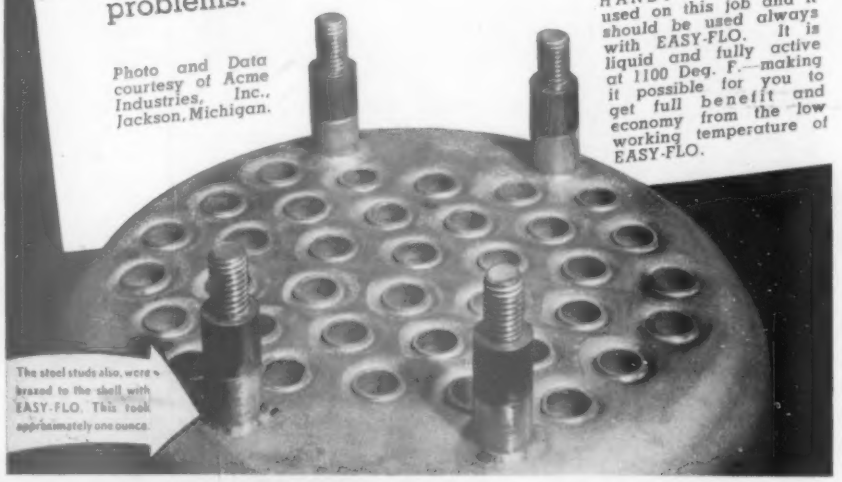
Only 2 ounces of 1/16" EASY-FLO wire were needed to make all 36 joints between the 5/8" copper tubes and the steel shell—a total of more than 70 linear inches of brazing. The cost of EASY-FLO per joint, based on medium quantity selling prices, amounts to about 1¾ cents.

Add to this economy in the alloy itself the further savings in time, labor and gases resulting from EASY-FLO'S exceptional fluidity and low working temperature (1175 Deg. F.) and you can realize why the use of EASY-FLO is spreading so rapidly.

Actual evidence, covering a wide range of ferrous, non-ferrous and dissimilar metal joining jobs, shows that EASY-FLO has speeded up production, improved joint quality and cut brazing costs for a large and growing list of manufacturers. A trial should prove EASY-FLO brazing equally profitable for you. Find out if this is so. Take the first step now—write today for EASY-FLO Bulletin WE-105—let us know if you want an engineer to call and talk over your brazing problems.

HANDY FLUX was used on this job and it should be used always with EASY-FLO. It is liquid and fully active at 1100 Deg. F.—making it possible for you to get full benefit and economy from the low working temperature of EASY-FLO.

Photo and Data courtesy of Acme Industries, Inc., Jackson, Michigan.



The steel studs also, were brazed to the shell with EASY-FLO. This took approximately one ounce.

HANDY AND HARMAN
82 Fulton St., New York, N. Y.
HANDY & HARMAN FOUNDED 1867 QUALITY SERVICE
Agents in Principal Cities
In Canada: HANDY & HARMAN of Canada, Ltd., Toronto

aluminum alloys. Reference was made to a wide variety of welding problems as they affect industry in general. This welding clinic was held by **Steel Sales Corp.** at their new Chicago warehouse, 3348 S. Pulaski Rd.

» «

General Electric Co. announces appointment of **Watkins Inc.,** formerly **Ben Sibbitt Iron & Foundry Co.,** 710 E. 1st St., Wichita, Kan., as distributor of G-E arc welding equipment, electrodes and accessories. The new organization will cover the southern half of Kansas. **E. A. Watkins** is president, **H. J. Nickel,** treas. and purchasing agent, and **R. J. Smith,** sales manager.

» «

John Nageldinger & Son, Inc., 409 E. 91st St., New York City, has just recently elected the following officers: **Louis F. Moskowitz,** vice-president; **Richard J. Wittman,** secretary. Manufacturing facilities and personnel have been enlarged to take care of expansion of its compressed gas business.

» «

The Weldcraft Service & Supply Co., operating in the past at 2500 E. 23rd St., Los Angeles, Calif., has moved into larger quarters at 1566 East Slauson Ave. **C. J. Nyquist,** manager, is well known in the welding industry on the Pacific Coast, having been active in that territory for more than 20 yrs. In conjunction with his service and supply business, Mr. Nyquist is also Pacific Coast divisional manager for the Magnaflux Corp.

A.W.S. Activities

Milwaukee Section A. W. S.—"Stainless Weld Metal and Welding of Stainless Steels" was the subject of a talk by **R. D. Thomas,** president of Arcos Corp., Philadelphia, Pa., at the April meeting of Milwaukee Section. Mr. Thomas proved to be very well versed in stainless steel welding problems. His talk covered weldability, procedure and corrosion resistance.

» «

Los Angeles Section A.W.S.—H. V. Thaden, sales and development engineer, Stainless Steel Div., **Carnegie-Ill. Steel Corp.,** spoke on the subject "Stainless Steel in Aircraft" at the April 18 monthly meeting held at Scully's Cafe, 4801 Crenshaw Blvd., Los Angeles, Calif. Mr. Thaden's talk featured the welding aspects of aircraft fabrication.

» «

Philadelphia Section A.W.S.—"Use of Welding in Ship Construction" was discussed by **David Arnott** of the American Bureau of Shipping at the regular monthly meeting held at the Engineers' Club, 1317 Spruce St., on April 15.

Pittsburgh Section A.W.S. — The third annual **Tri-State Welding Conference,** which was sponsored jointly by the **Pittsburgh Section A.W.S.** and the **Engineers' Society of Western Pennsylvania,** was held Friday, April 26. Hats off to the Pittsburgh Section for staging a very creditable one-day conference. A capacity crowd visited the Neville Island fabricating plant of Dravo Corp. on Friday morning. The party left in chartered busses from the William Penn Hotel, at 10:30 a. m., arriving a half-hour later at the Dravo plant. About 125 engineers had an opportunity of inspecting one of the most modern barge building plants in the country. Just before luncheon in the Dravo cafeteria, the inspection party witnessed the launching of a welded coal barge.

The afternoon technical session included the following three technical papers: "**Distortion Problems,**" **by Charles H. Jennings,** Chemical and Metallurgical Department, Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa.; "**Low Alloy Steels For Welding,**" **by Dr. A. B. Kinzel,** chief metallurgist, Union Carbide and Carbon Research Laboratories, Inc., New York City; "**Modern Steel Structures,**" **by H. W. Lawson,** engineer, Bethlehem Steel Co., Bethlehem, Pa.

At the evening session, 8 P. M., **William Spraragen,** technical secretary,

Want A-C Economy PLUS BETTER WELDING?

GET IT with G-R

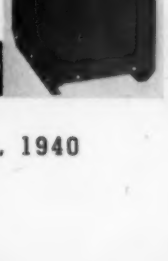
WITH high efficiency (up to 96 per cent) *plus* ideal arc characteristics at all heats, full-range stepless control and job-tested dependability, G-R offers years-ahead advantages in *better welding* at *lower cost.*

There's a G-R unit for *your* job... seven models (15-135 to 90-1250 ampere ranges) to meet your requirements exactly. G-R units for automatic head and Unionmelt processes are job-tested cost-cutters, too!

REMOTE CONTROL available for all G-R models (regulate heat without breaking arc!).
MULTI-CIRCUIT operation optional on larger units.

● *Call your local jobber, or write us today for free literature . . .*

ATTENTION EQUIPMENT JOBBERS: *Some Eastern and Mid-western territories open; write at once for complete information.*



GLENN · ROBERTS COMPANY, INC.
1004 FRUITVALE AVENUE · OAKLAND CALIFORNIA U. S. A.

"Like Putting Money in the Bank," say Sight Feed Users.

And it is a fact! For every dollar you invest in a Sight Feed Portable Acetylene Generator, you get $2.00 - $3.00 - $4.00 in return—*the more acetylene you use the greater your saving* with Sight Feed.

Invest your capital where it will bring the greatest return. Write today for the Sight Feed catalogue.

THE SIGHT FEED GENERATOR CO.
Richmond, Indiana

A.W.S., presented the aims and the advantages of joining the American Welding Society. Following Mr. Spraragen, **George T. Horton,** currently president of the American Welding Society, and also president of the Chicago Bridge & Iron Co., presented an informal lecture on welding applications with the aid of numerous slides covering a diversified group of industries. These illustrations of modern welding practice proved unusually interesting because of George Horton's witty style of presentation.

Trade Literature

Sellstrom Eye Protection—Sellstrom Mfg. Co., 615 N. Aberdeen St., Chicago, has just issued a 72-page catalog (No. 18) fully illustrating the complete line of Sellstrom eye protection equipment, which includes protective lenses for practically every industrial purpose. Welding goggles and helmets are prominently featured in the new catalog. A variety of general purpose industrial goggles is also shown. Industrial respirators for dust hazards and safety gauntlets are also listed in this catalog.

» «

New Guide to Nickel Alloys—A general guide to the uses and properties of nickel and high-nickel alloys is incorporated in a new illustrated booklet recently published by **The International Nickel Co.** In a 16-page, pocket-size edition, this new publication "Seven Minutes With Seven Metals," includes material on Nickel, Monel, Inconel, and associated alloys in both mill and clad forms. Space is also devoted to the properties and uses of these metals in cast form.

While prepared under technical supervision, the guide was edited for both technical and non-technical readers. It is being distributed without charge by The International Nickel Co., 67 Wall St., New York City.

» «

"Sheet Metal Welding Fundamentals," has recently been published by **The Linde Air Products Co.** The booklet covers such subjects as design factors, control of expansion and contraction, use of jigs, weldability of the material, and welding procedure. It should be of particular interest to the aircraft industry and all fabricators of light-gauge metal, whether sheet metal or light-wall tubing.

Also included in the booklet is a supplementary outline for teaching the welding of sheet metal and tubing. Recommended as a brief, to-the-point aid for instructors in welding schools and colleges, the outline contains suggestions for lectures, demonstrations, shop work, and study references for 30 lessons.

Copies of this 16-page booklet, Form 4435, are available upon request. Write to the nearest office of The Linde Air Products Co. or to the company's headquarters at 30 East 42nd St., New York City.

Recent Patents

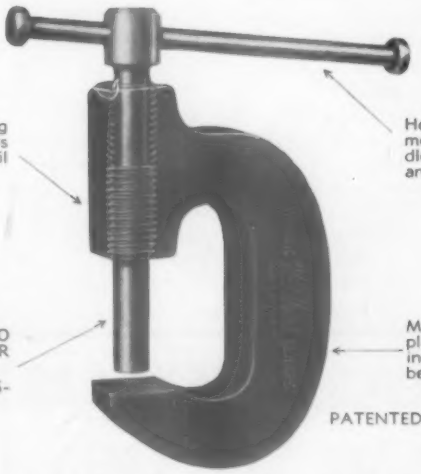
Volatile Flux

2,194,920. **Thomas H. Vaughn, A. R. Lytle,** and **J. M. Gaines, Jr.,** Buffalo, N. Y., assigned to **Union Carbide and Carbon Research Laboratories** of New York. Filed Aug. 31, 1937. Issued Mar. 26, 1940. Difficulties of hydrolysis which are encountered while using volatile fluxes may be overcome by proper heat control. Many of the most effective volatile fluxes, such as the various organic borates and silicates are readily hydrolyzed by moisture, even by such small amounts of moisture as occur in the welding gases used in welding. Upon hydrolysis, these compounds deposit the free acids in solid state, as boric acid, silicic acid, etc. This is particularly likely to occur in connection with use of a heavily moisture-laden gas such as low pressure generated acetylene. In the preferred method employed by the inventor, a novel blowpipe is employed which is provided with a nozzle having an outer annular jacket associated with the nozzle. The flux solution is fed through the jacket and is heated by heat absorbed by the nozzle from the welding zone and the highly-heated metal parts being welded. The fluid thus volatilized is then introduced under regulated pressure into the stream of welding gases within the blowpipe nozzle or adjacent

"Red Head"

WELDING CLAMPS

Withstands All Welding and Handling Abuses


Heat treated for long wear. Threads always protected. Retains oil for long period.
Heat treated chrome molybdenum alloy handle offers great resistance to bending.
MAIN FEATURE
NO THREADS TO DAMAGE IN OPEN OR CLOSED POSITION.
WELD SPATTER EASILY REMOVED.
Made from solid steel plate, heat treated, giving great resistance to bending or twisting.
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to the nozzle outlet. The velocity of the gas stream prevents any solid hydrolysis products from depositing in the nozzle passages, and insures uniform continuous operation of the blowpipe. By means of this process any type of combustible gas can be utilized, including those containing high percentages of water. Moreover, the necessity for removing moisture from the gases is avoided. Furthermore, the invention permits the use of those liquid fluxes which, because of their low or variable vapor pressures, are not ordinarily adapted for use in welding methods.

» «

Scarfing Torch Rod Feeder

2,195,944. **Edward H. Stream,** Chicago, Ill. Filed June 27, 1938. Issued Apr. 2, 1940. The object of this patent is the provision of a scarfing torch rod feeder designed to effectively handle rods of different sizes, in which the rod feeding mechanism is so designed as to compensate for structural irregularities in the rod, thus eliminating necessity of making adjustments to attain proper feed delivery of the rod. The rod feeder includes a positively-driven feed wheel rotating about a stationary axis, together with a companion feed wheel of the idler type, rotating about a shiftable axis, together with means for shifting the companion feed wheel for accommodating rods of different diameters.

» «

Electrode Storage Feed

2,195,962. **Klaus L. Hansen** and **A. V. Huennekens,** Milwaukee, Wis., assigned to **Harnischfeger Corp.** of Wis. Filed Oct. 16, 1936. Issued Apr. 2, 1940. An automatic welding apparatus is described in which a welding rod carrier moves between a storage receptacle for ordinary coated welding rods and the work. A welding rod gripper is provided having a charging position in which it is adapted to grip one end of the foremost rod in the storage receptacle and thereafter move with the rod to a welding position. The arc is automatically maintained by the automatic adjustment of the electrode holder during welding.

» «

Gang Spot Welder

2,194,678. **E. G. Biederman,** Detroit, Mich., assigned to **General Motors Corp.,** Detroit. Filed July 7, 1938. Issued Mar. 26, 1940. This patent describes a gang spot welder in which all the electrodes are arranged to remain in contact with the work, while the successive welding operations take place. The successive electrodes for successive welding shots are selected by a plurality of secondary switches, preferably in the form of a commutator brush or roller and commutator segments. A timing switch is located in the secondary circuit so as to speed up the operation.

» «

Butt Welding

2,196,180. **James L. Anderson,** Closter, N. J., assigned to **Air Reduction Co.,** Inc. of New York. Filed July 27, 1935. Issued Apr. 9, 1940. Improved end welding of tubing is claimed to be possible by heating the ends with a special torch. The torch directs a circle of flame jets against the opposing end faces of the tubing, and the torch is oscillated through an angle at least as great as the arc between successive flame jets directed against the same tube end. By this procedure the ends are substantially uniformly heated. The torch is adapted to heat the opposing ends of both tube ends, while they are moving together and up until their faces are in actual contact. This permits welding to take place without spatter or flash.

Oxygen Welding

2,196,191. **Ward H. Broadfield,** Scarsdale, N. Y., assigned to **Broadfield Metals Corp.,** Dover, Del. Filed Apr. 9, 1936. Issued Apr. 9, 1940. In the welding of ferrous metals, such as metal pipe, the edges of the ferrous plate are heated to welding heat by the application of oxygen and hydrogen, the oxygen being present in major proportion, sufficient hydrogen being present to form an hydro-oxide scale. The heated metal is subjected to a reducing atmosphere to remove the hydro-oxide scale prior to the pressing of the edges of the plate together to form a welded bond. If oxygen is used without added hydrogen a ferrous oxide scale is formed, which is difficult to remove. In one form of carrying out the process, the inventor introduces water or steam into the oxygen stream to form a hydro-oxide scale which can be easily removed. The hydrogen is obtained from the water or steam which is used.

» «

Continuous Tube Welding

2,196,192. **Ward H. Broadfield,** Scarsdale, N. Y., assigned to **Broadfield Metals Corp.,** Dover, Del. Filed Apr. 28, 1936. Issued Apr. 9, 1940. In accordance with this invention, a continuous strip of pipe-forming metal is fed through a suitable heating unit. Two sets of forming rolls are provided to shape the metal. While one set of rolls is in service the other set is withdrawn from service for repair, cleaning, or eventual replacement. By using two sets of rolls production can go on continuously.

» «

Boric Acid Flux

2,196,853. **Lionel Cinamon,** New York, and **Samuel Sklarew,** Yonkers, N. Y., assigned to **Special Chemicals Corp.,** New York, N. Y. Filed Oct. 27, 1938. Issued Apr. 9, 1940. A non-toxic flux which does not cause discoloration on welded copper may be prepared, the invention discloses, by mixing together boric acid, an alkali acid fluoride, and alkali borate and sufficient water to form a paste. About 1½% to 10% of fluoride is used. From 3% to 37% of alkali borate is present. The fluoride should always be present in an amount less than the amount of the alkali borate. The water may be omitted entirely to give a dry flux. The new flux has a low melting point; it readily cleanses copper and preserves the brightened surfaces in condition for welding; and it does not attack, pit, or discolor copper metals.

» «

Electrode Coating

2,194,712. **Wilber B. Miller,** Niagara Falls, N. Y., assigned to **Oxweld Acetylene Co.,** of West Virginia. Filed June 11, 1938. Issued Mar. 26, 1940. Success- of the columbium-containing chromium steels, including specifically the columbium-containing chromium steels, is obtained, according to the inventor, by the use of a new coating for electrodes having a core of chromium steel, preferably

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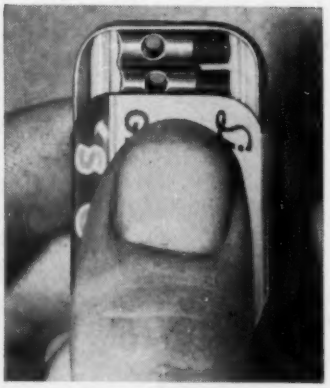

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of the columbium—containing chromium steels. The coating material of the invention comprises, in parts by weight, as essential ingredients 20 to 40 parts of rutile, or an equivalent source of titanium dioxide, 15 to 20 parts clay which is preferably slip clay, 10 to 30 parts of alkaline earth metal oxide, which may conveniently be in the form of carbonate or silicate, 5 to 15 parts of alkaline earth metal fluoride, and 4 to 8 parts of silicon or manganese, and a binder. The silicon may be in the form of commercial ferro-silicon and the manganese may be in the form of low carbon ferro-manganese. If desired, up to about 6 parts of columbium, suitably in the form of ferro-columbium, may be added. Advantages are said to be obtained, in some instances, where the calcium is used as calcium titanate or calcium titano-silicate. Any suitable binder may be used, according to the patent. As an example, the inventor suggests about one part of sodium silicate solution of commercial strength to about three and one-half parts of the dry welding composition.

Classified Section

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Combination Welder, school graduate with 2½ yrs. experience in pipe, sheet metal and general welding. Go anywhere. Age 25. Address S. Amber, 1620 S. 50th Ave., Cicero, Ill.

Arc Welder, recent graduate of Omaha Welding school. Age 21. Limited experience. Prefer to work near Omaha. Single. Address Donald C. Meyer, Route 2, Nehawka, Nebr.

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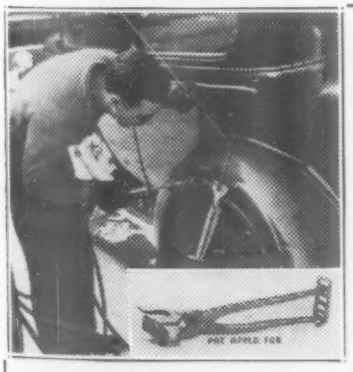

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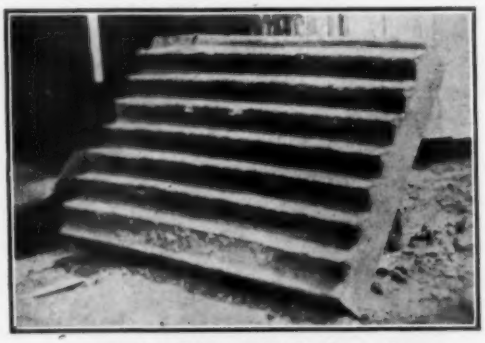

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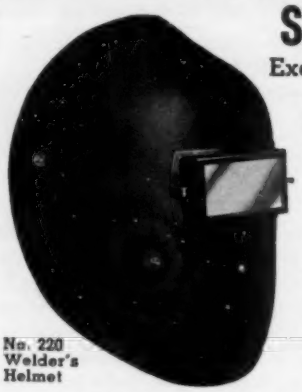

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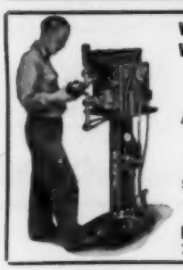

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